MANUAL

OF

EYE SURGERY.

BY

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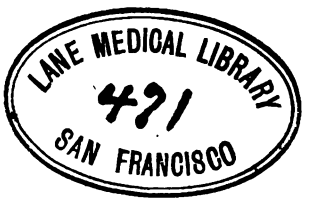

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PREFACE.

In surveying the field occupied by ophthalmic writers I found the ground well covered with elaborate treatises; but, in most instances, the subject of eye surgery has been treated by "specialists" for the benefit of "specialists," and the general practitioner was left without a work adapted particularly to his wants.

Recognizing the merits of the several hand-books already in existence on this subject, but thinking that in one feature or another they fail to meet the requirements of the ordinary physician, I have endeavored to supply this apparent need.

Such progress has of late been made in ophthalmic practice, that much which is said about the eye in the older surgical works, is now obsolete. Besides, the science of eye surgery has become too elaborate and extended to be embraced in a text-book devoted to general surgery. To this reason may be ascribed the failure to do justice to it in the somewhat comprehensive works of Gross and Erichsen. Although I have called this work a MANUAL, I have aimed at being thorough and systematic in the preparation and arrangement of what recent research has contributed to an eminently progressive branch of surgery. The physician of varied practice will find that degree of elucidation which will enable him to execute all the easier operations, and to comprehend what the expert oculist performs. Conciseness has been rigidly observed, yet no topic of importance has been sacrificed through a disposition to merely epitomize. Salient and practical points have been presented in the fewest words possible, though not at the expense of perspicuity.

The ophthalmoscope has thrown so much light upon obscure diseases of the eye, that the instrument is indispensable to the proper diagnosis of certain morbid conditions; yet the beginner need not expect to gain much advantage from its use. It requires practice to become expert in making observations with any instrument of the kind. Only a trained observer understands the powers of the microscope or of the telescope. A novice could see about as much with one instrument as with the other, whether looking at near or distant objects.

It has been considered excusable to omit a lengthy dissertation upon the general laws of optics, as well as upon the physiology of vision. These topics are fully discussed and well illustrated in works accessible to every student; and such subjects as the reflection, refraction, and the diffusion of light, have no legitimate place in a work on the surgery of the eye. Though the eye is confessedly an optical instrument, its immediate connection with the brain renders it a living piece of mechanism, which is legitimately discussed by the physiologist.

The nomenclature encountered in treatises devoted to diseases of the eye is truly formidable; especially for those who have given little attention to the technicalities employed by writers upon ophthalmology. Indeed, it would be proper to append a glossary, were it not that every reader of medicine is presumed to have a lexicon, to which he may refer for the definition of rare and complicated terms. Although I have employed the scientific names for morbid phases, I have endeavored to make use of such synonyms, paraphrases, and explanations as were available while discussing a subject notoriously technical. There are no common names for the majority of eye diseases, consequently it would be absurd to attempt to write upon ophthalmology, and affect to ignore technicalities. Besides, the learner obtains more information from a definition found in the dictionary than at first might be supposed. Owen, in the Preface to his "Skeleton and Teeth," says: "Without learning and understanding the technicalities of a science, that science can not be comprehended. The terms seem 'hard' only while the ideas which they represent are not understood. * * * * * To the intelligent reader of every class,

who may be blessed with the healthy desire for the attainment of knowledge, let it be said: Be not discouraged with the array of 'hard words' which seem to bar your path in its acquisition. When such words are invented or adopted by the masters in science, be assured that your acquisition and retention of their meaning, will be the safest 'first steps' in the science of your choice."

The illustrations, which are thought to be sufficiently numerous, are mostly taken from Stellwag, though several are copied from other authors. Some are modifications, and only a few are original. Such a degree of perfection has been attained in the illustration of ophthalmic diseases and operations upon the eye, that there is little need for new pictures.

COMPARATIVE ANATOMY OF THE EYE.

THE organ of sight in animals of the most simple construction consists of a primitive *eye-spot*, or is confined to the expansion of a nerve on which the rays of light impinge, producing, as may be supposed, exceedingly vague sensations of vision.

In the different grades of animal life a marked variation is observed in that part of the organism endowed with the function of seeing. But in all, from the lowest to the highest, the essential feature of the visual apparatus is a sensitive nervous expansion on which light makes an impression.

The sense of sight, so far as obtaining a notion of the outlines, dimensions, and relative positions of external objects may be concerned, is allied to that of feeling. Many of the lower animals have no power of seeing, but depend upon the sense of touch for a knowledge of the things they come in contact with; the blind fishes of Mammoth Cave have feelers of great length and sensitiveness, by means of which they discover food and obtain impressions of surrounding objects. Snails can both see and feel by means of long tentacles, which have eyes mounted on their ends.

Many insects, like the fly and the bee, have what are called *compound eyes*, the visual mechanism not being composed of parts which enter into the construction of the simple eye of the higher animals, but is made up of a series of cones arranged somewhat like a piece of mosaic, a single cone with its hexagonal facette (segment of cornea) representing, in the act of seeing, only one portion of the figure, yet the entire lot, in combination, completing the image of anything seen. The number of these little eyes, or segments of an eye, is extra-

ordinary, amounting to thousands in the dragon-fly, the butterfly, and a species of beetle.

The higher animals have two eyes which are spherical in form and situated on each side of the skull in bony cavities called orbits. But some of the lower creatures have a multiplicity of eyes. The star-fish has an eye at the extremity of each of its rays; and the spider possesses eight eyes in a group on the anterior aspect of its back.

Several varieties of flat-fishes with asymmetrical bodies, have singularly twisted heads, and both eyes on one side. The anableps has a cornea bisected by an opaque horizontal line, and an iris perforated by two pupils. In the eye of the tope and blue shark there is a nictitating membrane superadded to a well developed circular palpebral fold of the skin. A strong nictitator muscle rises from the temporal side of the orbit, and passing through a muscular and ligamentous loop, descends obliquely to be inserted into the lower margin of the third lid.

There is no lachrymal gland in fishes, the lubrication of the eye depending upon the liquid medium in which such animals perpetually move. The cornea of fishes is flat, and to make up for the small quantity of aqueous humor, the refractive power of the lens is maximised by its spherical form. The sclerotic is usually cartilaginous or bony.

In some reptiles which possess eyelids, the lower is the nictitating one, the upper lid merely following the movements of the eye ball when it is turned down. The muscles which move the lower lid pass through pullies at each angle of the orbit. They arise from the lower and back part of the eyeball.

Serpents have a transparent layer of epidermic material which covers the eye; and this, after becoming opaque, is shed in connection with that of the head and body at the exuviating period. In the chameleon each eye enjoys an independent motion. In all reptiles the optic nerve penetrates the sclerotic externally to the axis of vision. The turtle has a nictitating membrane situated vertically at the inner canthus, and having a horizontal motion. The crocodile and alligator have powerful and complex eye-appendages, not less than thirteen muscles contributing to movements of the eyeball and lids.

The eyes of birds are remarkable for their great size, as compared with the brain and head, and possess extraordinary powers of adjustment—a quality which is necessary to keep objects distinctly in view during rapid flight. The anterior segment of the eye is more prominent than in other classes of animals, the cornea projecting forward in a marked degree. In the owl there is a great disproportion between the anterior and posterior divisions of the globe, the axis of the anterior portion being twice as great as that of the other. This gives room for an unusual quantity of aqueous humor, and for the lens to come forward, so that a greater convergence is given to the rays of light. The pupil is vertically oval, and seems, in its variability of movements, to be under the influence of the will. It is certainly very dilatable and active in its changes. The pupil of the parrot contracts and dilates independently of the quantity of light to which the eye is exposed.

A peculiar feature in the eye of birds is a plicated vascular membrane blackened with pigmentum, and situated in the vitreous and in front of the retina. This is called the *marsupium* or *pecten*, and is analogous in structure to the choroid. The functions of the marsupium are not well understood, but the choroid character of the membrane indicates that it is an absorber of light.

All birds have a third lid, or nictitating membrane, which sweeps over the eyeball horizontally, from the inner to the outer side of the globe. The lower lid is the one which closes the eye in sleep—a peculiarity marked in reptiles.

In the scale of mammals there is but one blind creature, which is the Italian mole, the burrowing habits of the animal rendering vision useless. There is an orbital impression in the skull, and an "ocellus" or rudimentary eye, but the skin covered with hair passes over these without an eye-mark. American moles have a small eye, so do other rodent burrowers.

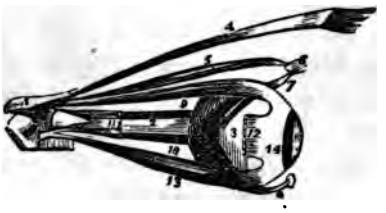
The eyes of elephants, whales, and other large animals are small in comparison with the bulk of their bodies. The eye of the rhinoceros is but a trifle larger than that of man. A broad belt of *tapetum* of metallic brightness is found in the choroid of the ox. The larger animals have the power of rolling the eyeballs in every direction, so as to view objects on all sides without moving their ponderous heads.

In man the eye is developed to the highest perfection; and in him it also performs a more exalted office than that of mere vision. It is a mirror in which are reflected his joys, his sorrows, and his passions,—and has been graphically called "the window of the soul."

ANATOMY OF THE HUMAN EYE.

Works on human anatomy contain illustrations of the eye as well as elaborate descriptions of the same, therefore it is unnecessary to repeat here what is in every medical reader's hands. The first and second diagrams represent quite distinctly the motor apparatus of the eye, and the general features of the exterior ocular arrangements.

FIG. 1.



1, fragment of sphenoid bone; 2, the optic nerve; 3, the globe of the eye; 4, the levator palpebræ muscle; 5, the superior oblique muscle; 6, its cartilaginous pulley; 7, its reflected tendon; 8, the inferior oblique muscle, with piece of bone to show the origin of the muscle; 9, the superior rectus muscle; 10, the internal rectus; 11, a part of the external rectus; 12 the external rectus, mostly cut away; 13, the inferior rectus; 14, the capsule of Tenon—"white of the eye."

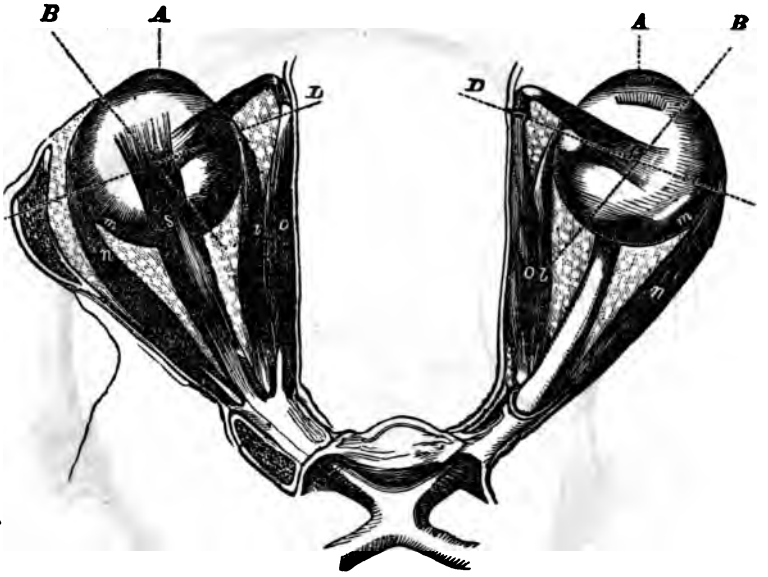
The eyelids, the conjunctiva, and the lachrymal apparatus will be described and illustrated when diseases of those parts are considered, a brief anatomical description introducing each topic. It is not deemed expedient to describe all the fascias and tissues of the orbital cavities, as some of them play unimportant parts in the pathology of the eye.

The eye is a dioptric apparatus, which by means of refractive and accommodative media has the power of casting the images of objects upon the retina, a nerve-membrane that conducts these impressions through the optic nerves to the brain, where their recognition is enforced.

The eye has been called an optical instrument of wonderful perfection; yet it has powers infinitely superior to any piece of art or mechanism. It has the property of adapting itself

rapidly to long and short ranges of vision, and of changing its axis with admirable facility. A hawk soaring at a great height can adjust its eye so as to observe distant objects with precision. A small bird on the ground is watched with the greatest accuracy, and is not lost to view when the hawk *stoops* upon its prey. Though descending swiftly through the air the eye of the hawk changes its adjustment so rapidly that

FIG. 2.



A A, the parallel optic axes; C C, the centres of motion of the globes; B B, the axes of rotation of the oblique muscles; D D, the axes of rotation of the superior and inferior straight muscles; N N, the internal straight muscles; O O, the superior oblique muscles, running through pulleys at D D; S, the superior straight muscle of the left eye; the muscle is removed from the right eye to show the optic nerve; M M, the attachments of the inferior oblique muscles; the view is from above, therefore the muscles can not be seen.

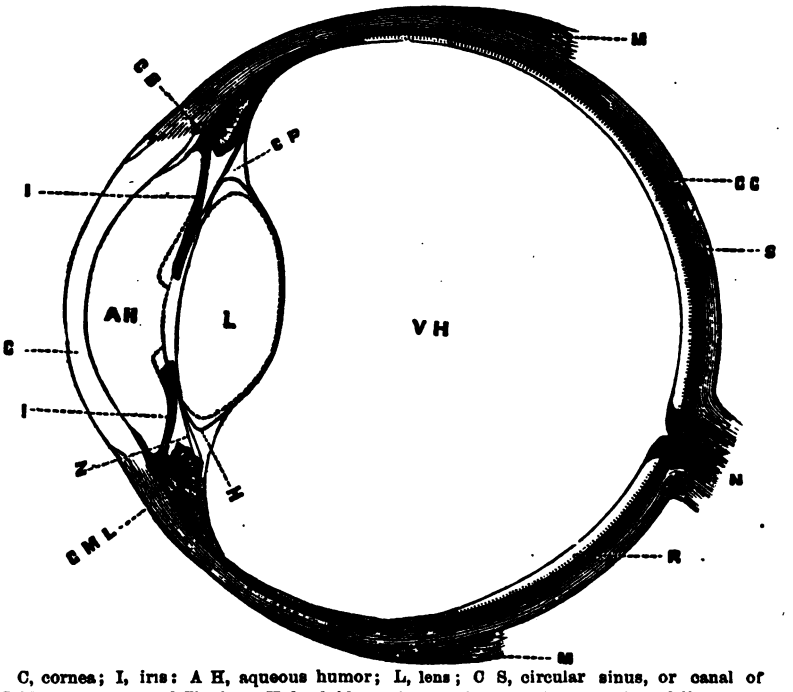
the victim is kept clearly in view until the fatal plunge of beak or talons is made. Although the human eye is not possessed of such remarkable accommodative powers as those of some animals, it will conform to different ranges of vision with great celerity.

By what is already shown in the accompanying diagrams it may be seen that the eye is a complicated structure; and that the kinds of derangements to which the several parts are liable, may be infinite. The shell, as it were, of the eyeball encloses the humors and delicate structures; the muscles move the globe in its socket; the lids with their cilia shield and

protect the parts within; and the lachrymal apparatus affords lubricating moisture.

By the action of the muscles the optic axes are held parallel, and the two globes are moved consentaneously. To a certain extent the oblique muscles are the antagonists of the recti. The latter tend to draw the eye back into the socket, and the former pull the globe forward. A division of the

FIG. 3.



C, cornea; I, iris: A H, aqueous humor; L, lens; C S, circular sinus, or canal of Schlemm; Z, zone of Zinnius; H, hyaloid membrane; C M L, ciliary muscle and ligament; C P, canal of Petit; V H, vitreous humor; R, retina; C C, choroid coat; S, sclerotica; N, optic nerve; M, muscle.

recti muscles would enable the obliqui to make the eye protrude; and to divide the obliqui would allow the recti to retract the eyeball deep in the socket. By the action of sets of these muscles the eyeballs may be moved to the right and left, and up and down; besides, a rolling motion may be imparted to the eyes by the compound action of both sets of muscles. By looking to the right or left, one eye turns *in*, and the other *out;* and, although different muscles in the two eyes perform the action, the movements effected are harmonious.

The eyeball is slightly less than an inch in diameter; and though spherical in appearance, is a little elongated in its antero-posterior diameter. The cornea, being the segment of a smaller sphere than the rest of the ocular shell, is more convex than any other portion.

The dense scleral substance or the *sclerotic*, maintains the shape of the eyeball, affords firm attachments for the muscles, and protects the delicate structures within. The *cornea* occupies the front part of the eyeball, and is a transparent structure—the window that lets the light pass into the globe. The *iris* is a disc, variegated in color, with a round hole in its centre—the pupil—and is situated between the cornea and the lens. The *aqueous humor* occupies the *anterior* and *posterior chambers* of the eye, the pupil forming a communication between the two apartments. The *lens*, a double convex transparent body located behind the iris and between the aqueous and vitreous humors, is enclosed in a capsule, and made to change its shape and position by the action of the ciliary muscle. The *vitreous humor* is that glassy appearing mass behind the lens, which occupies the large space called the fundus of the eye. The *retina* is the sensitive membrane, spherical in shape, which is spread out in the fundus of the eyeball to receive visual impressions. It is a prolongation of the optic nerve. The *choroid* is a pigmentary and vascular membrane between the retina and the sclerotic.

The *conjunctiva* is essentially a mucous membrane, though moistened by the lachrymal fluid. It affords a lining to the lids and a covering to the anterior portion of the eyeball. The part which forms the external layer of the cornea is transparent and exceedingly thin, and the part which extends from the borders of the cornea to the palpebral sinuses, hiding the attachments of the recti muscles—"the white of the eye"—adheres loosely to the parts beneath. In the free borders of the *lids* are the *tarsal cartilages*—two semicircular hoops—which give form and support to the softer tissues of the lids, and attachments to the palpebral muscles. In the substance of the tarsal cartilages are embedded the *Meibomian glands* which have ducts opening near the inner margin of the edge of the lids. The *cilia* grow from the outer edge of the lids, having their follicles in the skin.

The *optic nerve* pierces the sclerotic a little internal to the

antero-posterior axis of the eye, and expands into the retina after entering the eyeball. The point of entrance is called the *optic disc*, a circular spot which can be distinctly seen by the aid of the ophthalmoscope. The optic nerve is enveloped in a dense fibrous sheath (neurilemma), which springs from the dura mater and blends at last with the sclerotic. In fact, the nerve enters the eye in bundles, and the passage of the fasciculi through the sclerotic is by a series of perforations, constituting the *lamina cribrosa.*

In the axis of vision the retina exhibits a deeply tinted yellow spot, called the *macula lutea.* This is a little to the outside of the optic disc, and is the most sensitive part of the retina.

EXAMINATION OF THE EYE.

Some tact and experience are required to examine the eye in a thorough and effective manner. A mote on the cornea or a distorted eyelash may escape an inexperienced observer, especially if the light be not good. It is essential, then, in examining the eyes for defects, to have the patient placed so that a clear, bright light shall fall upon the parts to be inspected. A pocket lens is a useful instrument to be employed in the examination of points not distinctly visible to the unassisted vision.

After the cilia and puncta have been scrutinized, the lids are to be opened so the conjunctiva, cornea, and iris, may be examined. The lower lid is easily depressed with the finger, but the upper needs to be everted in order to expose its under surface, as well as to exhibit the sclerotic, cornea, and iris. A probe laid upon the upper lid parallel with its free edge and gently pressed downwards, while the thumb and finger, grasping the cilia, exert an upward force, will readily evert the tarsus and expose the parts beneath. The lids may be held apart by using the thumb and finger to press in opposite directions. The manipulation should be conducted with due regard to the sensitive nature of the parts. Rough usage provokes opposition on the part of the patient, and an obscuring flow of tears.

Children affected with photophobia will baffle all ordinary efforts to open the lids in a bright light, therefore it may be necessary sometimes to use an anæsthetic before an attempt is made to expose parts beneath the lids. It is surprising what involuntary force will be exerted to hold the lids closed when the eyes are morbidly intolerant of light. And it would involve a risk to try to overcome the spasmodic action in a young patient not rendered insensible. The cilia and lids may be slippery with tears and purulent secretions, so that the fingers will not make a secure hold. Besides, if the lids be forced open while the patient is exerting great resistance, the rolling eye will turn the cornea upwards and inwards to an extent which hides the greater part of it.

If only one eye be diseased, it is advisable to compare its condition with that of the other; in fact, it is well to compare the conditions of the two eyes when both are diseased. The comparison extends to the condition of the lenses if they be visible, the size of the pupils, the tints of the irides, the configuration of the corneæ, and the vascularity of the sclerotics and conjunctival membranes. Contrasts are often valuable in estimating morbid states.

It is seemingly easy to determine which is the strabismic eye, and what the degree of squint; but so great is the difficulty that an instrument—called a *strabismometer*—has been devised for measuring the degree of deviation existing in any particular case. A plate of ivory or glass, graduated, and made to fit the lower lid, and having a central dot to correspond with a vertical line drawn through the pupil when the eye looks straight forward, constitutes the instrument. Now, if the eye is affected with convergent or divergent squint, the centre of the pupil will be one or more lines to the right or left of the central dot on the scale, and the extent of the deviation is thus measured.

In the absence of a strabismometer, the same information can be obtained by directing the patient to look at an object some distance in front of him, and then making a mark on the lid corresponding to the centre of the pupil of the squinting eye; then, if the patient close the sound eye, and with the other look at the distant object, the squinting eye will assume a straight position, when another mark must be made on the

lid below the pupil; the distance between the first and second dots will denote the angle of squinting.

The iris has to be examined to determine whether it dilates and contracts freely. If the pupil be too large and remain steadily in that condition, the cause must be investigated. Ordinarily if the eye be shaded for a minute or two with the hand, the pupil will enlarge rapidly, and when the light is let in it will as quickly contract. Belladonna, stramonium, and other agents, when applied to the lids or the integument in the vicinity of the eye, will cause the pupil to dilate; and the use of opium will influence it to contract. Choroido-retinitis, an inflammation in which the iris is usually involved, is commonly attended with a dilated state of the pupil, especially when the eye is under the influence of bright light, and when the pupil would be contracted if the eye were sound.

In synechia and other mechanical impediments to the movements of the iris, atropine is used to determine the mobility of the pupil. In cases of synechia the effect of atropine is usually to throw the pupillary border of the iris into serrations or irregular elevations and depressions.

If the iris be dilated and inactive, the inference is that the deep structures of the eye, especially the retina, are diseased. In concussion of the brain the pupil is usually contracted; and in compression it is dilated, though either condition may exist and the pupil remain at its normal size.

An instrument—called a pupilometer—has been invented to measure the size of the pupil under different circumstances. It is not of much use; yet those who enjoy a great variety of implements will add it to their *armamentaria*. It consists of a horizontal bar, on which a scale of degrees is marked; attached to this are two vertical bars, the one fixed and the other moveable by means of a screw. In use the edge of the fixed vertical bar is brought into a line with the inner edge of the pupil, and the sliding one is gradually screwed up till its edge corresponds with the outer border of the pupil. The space between the two bars, corresponding to the diameter of the pupil, is measured by the graduated horizontal bar.

Some persons naturally have small pupils, and others large ones. A wide pupil is considered a mark of beauty; and mydriatics are sometimes used by ladies about to appear where personal attractions are likely to excite flattering remarks,

though the artificially dilated pupil lets in so much light that the condition is detrimental to vision.

The lachrymal apparatus has to be examined with care to ascertain its defects. The position and condition of the puncta are to be observed, and the permeability of the canaliculi tested by the use of small probes. Pressure upon the lachrymal sac, causing its contents to pass along, or regurgitate through the canaliculi, is an easy method of ascertaining the nature of the fluids in the sac and the strictured state of the nasal duct. Either an overflow of tears, or a lachrymal fistula indicates obstruction of the nasal duct.

Distortion of the cilia, or malposition of the eyelashes, can not be fully seen without a critical examination of the tarsal borders in a strong light, and with the aid of a pocket lens. A look from directly in front of the patient is not so good as a side or oblique view. While the inspection is made the lids should be closed slowly in order to see whether a twisting hair is forced upon the cornea by the closing lids. A single "wild-hair" may create a troublesome conjunctivitis. Eczema of the tarsal borders, often indicated by thickening of the edges of the lids, and a scaly condition of the spaces between the lashes, should be considered; and parasites should not be overlooked.

Tension of the eyeball is to be estimated rather than measured. A finger placed against one side of the eye, the lids being closed, holds the eyeball steady while the forefinger of the other hand exerts gentle pressure or palpation upon the opposite side of the globe. The resistance and elasticity offered by the eyeball indicate the degree of tension. A healthy eye can be easily indented, yet one which is glaucomatous offers a stony hardness. Mr. Bowman has gone so far as to designate nine degrees of hardness, and represents each by arbitrary signs, which are too uncertain and "doubtful" to be of much value. No two experimenters would be likely to agree in regard to a shade of variation so refined as nine degrees of tension might demand.

Test types are now very commonly employed to demonstrate the acuteness of vision; and are of great practical utility. Snellen's test types, which belong to an oculist's apparatus, consist of different sized letters on blocks—the sizes ranging from No. I. to XX. The smallest, or No. I., is seen by a

normal eye at a distance of one foot and can not be distinctly made out beyond that distance. The next size, No. II., is seen at a distance of two feet at the same angle, and so on, a foot being allowed for each letter, up to No. XX. The different distances at which the several sizes of type can be distinctly seen, indicate the degree of acuteness of vision in the persons making the tests.

Jarger's tests are printed from common type, and are put into words; and these again into lines or sentences, the size of the type varying in the different lines or sentences, from the smallest that can be read at the closest range of accommodation, to those large enough to be distinctly made out at a distance of twenty feet.

It may be desirable to ascertain the extent of the visual field, in order to learn what part of the sentient surface of the retina retains its integrity. This may be done by seating the patient a foot from a blackboard, and making on its centre a small cross with chalk. At this mark the patient is to fix one eye, the other being closed. A line is now drawn with the chalk in several directions from the central point—to the right and left, and upwards and downwards, the patient stating, as the lines are drawn, when the extreme limit of vision is reached. Intermediate lines may then be drawn, all radiating from the centre. The outline thus established indicates the limit of the field of visual perception. After one eye is thus tested, it may be closed, and the other subjected to a similar test. If a retinal lesion prevents the patient from seeing the radiating lines with the same distinctness, the region of imperfect perception should be marked in the diagram.

THE OPHTHALMOSCOPE.

Like most other discoveries, that of the ophthalmoscope was by the gradual development of an idea. Cumming demonstrated that, by a certain arrangement of light, the fundus of a healthy eye could be made visible. Although he never obtained a view of the optic nerve or vessels of the retina, his experiments prepared the way for a progressive

discovery which was made by Helmholtz in 1851. The next year, Ruete brought out an ophthalmoscope quite in advance of the imperfect apparatus of his predecessor. Coccius, the following year, carried nearer perfection the work so auspiciously begun. The essential part of the instrument now in common use, consists of a concave mirror having a perforation in the center. The mirror is mounted in a metal frame, to which a handle is fixed.

Before examining a patient's eye ophthalmoscopically, the pupil should be dilated with atropine of a strength not to exceed a grain to an ounce of water; and then the observer takes a seat in front of the patient who is seated near a jet of

FIG. 4.

Method of using Liebrich's Ophthalmoscope.

gas, or a table on which stands a lamp giving a brilliant flame. The light should be on a level with the patient's eye, and just far enough behind him to prevent any of the direct rays from falling on his cornea. The observer places the back of the mirror close to his own eye, so that he looks through the central aperture, and holds the instrument at such an angle that the reflected light from its concave and brilliant surface falls upon the patient's pupil. To do this requires considerable practice, though it is not difficult to accomplish. The observer knows when he holds the instrument in the right position, and at a proper distance from the eye, by seeing the retina assume a brilliant reddish appearance. While holding the ophthalmoscope in this position with one hand, the other holds a convex glass at such a distance in front of the cornea

as to allow the retina to come within its focus. If the fundus of the eye be properly illuminated, and the convex glass correctly placed, some of the retinal vessels can be distinctly seen.

To bring the optic nerve into view, the patient must direct the eye a little towards the nose; and by turning the eye in various directions every portion of the retina is successively brought under the view of the observer.

If the ophthalmoscope of Liebreich be used, it may be employed much as is represented in the accompanying diagram. The mirror is held near the observer's eye, and about a foot from that of the patient. In what is called the *direct* method of using the ophthalmoscope, the object-glass is not employed, but the mirror is moved towards the patient's eye, and at different distances the optic nerve, macula lutea, the arteria centralis retinæ, with the veins, may be seen; and the image is *erect*.

In the *indirect* process, as seen in the diagram, an object-glass is employed; and the rays of light reflected from the fundus of the eye strike the convex glass, and form an *inverted* image.

The appearances of the healthy eye as presented through the medium of an ophthalmoscope, have to be understood before morbid phases can be appreciated. In the sound eye the retina does not present a uniform color in all cases, but the tint varies from pale red, through shades of pale orange and yellow-orange, to buff. In vigorous persons the retina has a much redder appearance than in the feeble and anæmic. The tint of the retina is due in part to its own capillary network of vessels, and partly to the vascularity of the choroid which imparts a ruddy hue to the retina.

Across the illuminated fundus of the eye will be noticed large vessels radiating from a central point towards the periphery. These are the large branches of the central artery and vein of the retina; and by directing the patient to turn the eye a little towards the median plane, these vessels can be traced to their parent trunks in the middle of the optic papilla. The arteries have thicker coats than the veins, hence the color of the blood is not so distinctly seen as in the veins whose walls are thinner. The artery casts a faint shadow on each side of it. No pulsation is observed in the retinal vessels

of a healthy eye; but heavy pressure on the eyeball with the finger will excite a decided pulsation both in the arteries and veins.

The optic disc presents a variety of appearances in persons who enjoy good sight. As age advances it becomes smaller, and often deviates more or less from that circular outline which is presumed to be the normal standard. Contrasted with the reddish tint of the surrounding retina, the disc appears cream-colored, or tinged with a pinkish-gray peculiar to the brain. The extreme edge of the disc is of a more decided white than the central portion. The retinal artery close to the ring of the optic nerve, bends around the vein and starts off to its destination in nearly straight, or slightly wavy lines, branching as it advances, until it forms a plexus—ora serrata—at the front margin of the retina. Veins accompany the arterial twigs.

The choroid can generally be seen through the retina, though with varying degrees of distinctness. The hexagonal pigment-cells of the choroid can often be discerned, yet they appear as if covered with a haze or mist.

In young persons the vessels of the choroid can scarcely be made out; but in advanced life the retina does not conceal the choroidal vessels as much as might be supposed by persons unaccustomed to make ophthalmoscopic examinations. The vessels are larger than those of the retina, and are closely packed together, having between them narrow linear spaces, in which dark pigment is visible. In early life the choroidal vessels are bright red, but in old age the color is reduced to a brownish tint.

Morbid appearances of the Retina, Optic Disc, and Choroid. No picture nor verbal description can convey an accurate idea of the morbid phases a diseased retina may present; and about the same may be said of the optic disc and the choroid. In many instances an abnormal appearance is observed, yet the patient may see clearly, therefore it would be a question whether the eye be diseased or not.

Even the dusky halo which surrounds the optic disc in persons with impaired vision, is not constant, though it has been considered as a distinctive pathological sign. Headache, excitement, and mental depression may develop the halo, and a season of repose carry it off. It is *well* to understand oph-

thalmoscopic appearances; it is *better* to comprehend their causes; and the *best* to be able to remove them.

At one time it was thought that the white patches seen in the vicinity of the optic disc, especially if they were crescentic in form, were sclerotic. Now it is known that they are fatty deposits on the choroid, or fatty transformations of the retina. The change of color depends upon a loss of pigment-cells. The fatty deposits and transformations may have sprung from chronic inflammatory action, though there often is no outward sign of such action. Scrofulous and syphilitic taints work so insidiously that it is difficult to determine the *modus operandi* of the morbid processes.

The extravasation of blood between the choroid and retina is followed by inflammation which calls out effusions or lymph. As the inflammation subsides the absorptive forces come in and remove not only extravasated and effused material, but pigment-cells and nerve-substance, producing a white patch by laying bare the sclerotic, and leaving a black ring around it. Extravasations of blood in the tissues of the choroid and retina are exceedingly dangerous to vision, yet very good recoveries have been known to follow such accidents. Recent extravasations are easily detected with the ophthalmoscope, but it is difficult to comprehend the nature of the lesion when important changes have taken place at the site of the extravasation.

Detachment of the retina from the choroid is a serious accident, and is recognized by a lobular gray mass which is in contrast with the reddish reflecting surface of that part of the retina which still retains its normal state.

A detached segment of retina oscillates with each movement of the eye, and exhibits upon its surface a wavy state of the displaced vessels.

A pearly white appearance of the optic disc, in contrast with a rose-tinted retina, and in combination with other unfavorable signs and symptoms, is not an appearance which is at all promising. "Cupping" or "indentation" of the optic disc is another sign of discouraging import, though in a less degree than some writers allow. In advanced life it may be a sign of atrophy and degeneration, and then the prognosis is, of course, unfavorable.

In syphilitic iritis and retinitis a cloudy condition of the

vitreous humor is sometimes observed; and shreds and filaments which appear black, though really whitish, float about in the vitreous body. The ophthalmoscope reveals these, and they are not the *muscæ volitantes* the patient sees.

REMEDIES.

Although the morbid affections of the eye are numerous, the remedies employed for their relief are comparatively few. An observant visitor to a well attended eye clinic would be surprised at the number of patients treated with a half dozen medicinal agents; and not less would be the surprise when it was considered that the greater portion of the agents employed are for topical uses, and applied to the conjunctiva.

Some ophthalmic diseases are so emphatically systemic that constitutional remedies alone will be necessary. Defective vision from lactation or other debilitating causes, requires no local treatment; and some forms of rheumatic and syphilitic iritis demand more general than topical medication. Many kinds of ophthalmic disease require both local and constitutional management. It is always judicious to consider the importance of employing constitutional remedies when there is any indication for their use; and a full habit or plethoric state is not always to be trusted as evidence of a constitution free from contamination. It is better to err on the safe side, by administering constitutional remedies when they are not needed, than to neglect them when they are important. It would be foolish in most instances to prescribe internal treatment for the relief of an eye which was worried by a mote beneath the lid, though a febrile condition was provoked by the local irritation. The removal of the primary cause would generally be followed by immediate relief. However, an eye which has been suffering for days from a foreign body beneath the lid, might not be wholly relieved by the removal of the irritating substance:—the inflammation may have produced local changes and systemic derangements which would require general treatment to overcome them.

As has been intimated, local remedies constitute a large

share of the agencies employed in the management of eye diseases. Collyria, medicated with astringents, stimulants, and sedatives, are frequently used, the strength being tempered to suit the conditions of the case. A caustic effect may be needed in some instances, especially to make a primary impression; and then the mildest applications must follow. It is sometimes necessary to cauterize granulations of the lids with nitric acid at full strength, the agent being applied with a pencil of wood. Vessels traversing the cornea often have to be obliterated with nitric acid applied with the point of a stick near the margin of the corneal structure. Ointments are not fit to be used inside the eyelids, except in rare cases. Unguents may be applied to the edges of the lids in ophthalmia tarsi, or to remove tetter from the follicles of the cilia. The mercurial ointments are all too irritating to be employed about the eye. Citrine ointment very much reduced with cod liver oil, has been highly commended in the treatment of eczematous lids, yet it is too irritating. Neutral glycerine with a small quantity of Fowler's solution—half a drachm of the latter to an ounce of the former—has done well when applied to the edges of eczematous lids. The same amount of Fowler's Solution to an ounce of "Cold Cream" is better.

A neutral sulphate of atropia is the mydriatic in common use. A grain or two dissolved in an ounce of water, and applied beneath the lids every few minutes will soon dilate the pupil. Belladonna and stramonium rubbed upon the lids will affect dilatation of the pupil. Aconite applied to the lids and parts about the eye when the pupil is dilated in "amaurosis," will induce contraction of the pupil or act as a myotic. Opium and its preparations ordinarily contract the pupil to pin-hole size. A myotic effect is also produced by the use of the calabar bean. The agent in the form of an alcoholic extract is employed locally to the lower conjunctival sac by means of a camel's hair brush. It should be greatly diluted with glycerine before use. Mixed with a solution of atropine the effect of each is neutralized. The extract of calabar bean, even largely diluted, is irritating, and should therefore not be used when not imperatively demanded.

Nitrate of silver and the salts of lead are not fit to be employed upon the cornea and conjunctiva, as they sometimes produce stains, deposits, and unfortunate cicatrizations. Sul-

phate of zinc and sulphate of copper, applied in substance or solution, are preferable to the salts and solutions of silver and lead.

Tannic acid in powder and solution has been employed to arrest purulent secretions of the conjunctiva and to constringe granulations of the lids. Powdered tannin, either alone or mixed with calomel, has been blown upon the cornea and conjunctiva to arrest suppuration, but other well known means are preferable. An aqueous or fluid extract of pinus canadensis is an excellent topical agent in the treatment of ulcers of the cornea, and diseases of the conjunctiva. The strength is to be gauged to the pathological conditions.

The pith of sassafras has been used in the formation of collyria, but it is doubtful whether the agent possesses any special value. Alum curds, and poultices of various kinds have been employed in the treatment of ocular inflammations, and although they are comfortable when first applied, they are known to favor suppuration, chemosis, and destruction of the cornea.

Local depletion by means of leeches and scarification is gradually going out of reputable use. The division of highly congested vessels in the conjunctiva gives transitory relief, but no permanent good is to be expected.

The use of water in the form of douches and wet compresses abstracts heat, therefore an agreeable sensation of coolness is effected by it when there is a high degree of inflammation in the lids and parts about the eye. Ice cold water provokes congestion of a part at first, and then by a contraction of the vessels and tissues produces pallor and a benumbed state of the parts chilled. Some sensitive patients can not endure the prolonged abstraction of heat without unpleasant effects.

The hypodermic injection of morphia has been employed for the subjugation of intense circumorbital pains, but the dangers attending the hypodermic use of medicines are too imminent to be risked on trivial occasions. Hydrate of chloral is an anodyne of power when employed in large doses, yet its effects are variable and unreliable. Chloroform may be inhaled to arrest insufferable pain; and applied to the skin in the vicinity of the eyes, exerts a sedative influence.

Internal or constitutional remedies are needed in the treat-

ment of ophthalmic diseases, especially when scrofulous, rheumatic, and syphilitic taints are known to exist in the patient. Iodoform is a powerful alterative, and may be used as such with marked effect. Iodides of potassium and ammonium, and other medicinal forms of iodine, may be administered with the expectation of their exerting an alterative effect.

Sulphur is an agent which should not be neglected when it is desirable to overcome constipation of the bowels, and to produce an evacuation of pasty consistence. Cathartics, as such, are rarely required in the treatment of eye diseases. However, an efficient unloading of the bowels is sometimes salutary in its effects. The mercurials, which are generally laxatives, have been largely employed in the management of ophthalmic affections, but it is questionable whether any particular advantage has been gained by their use. They are depletory and devitalizing in their action, and therefore unfit for general use. Some of the most eminent oculists continue to employ the mercurials, yet sparingly and with many precautions. Once it was thought that iritis and retinitis could not be successfully treated without ptyalism; but now it is known that these diseases will succumb more satisfactorily without mercury in any form. Even in syphilitic iritis there is no necessity for a mercurial, better results being obtained by the use of iodides, sulphur, iron, mineral acids, salines, and bitter tonics. Stillingia, sarsaparilla, and other vegetable alteratives help to eliminate a scrofulous taint, but the effect is more decided when an iodide is combined with them. A syphilitic contamination is not eradicated by any single medicinal agent, but has to be expelled by a variety of remedial impressions made at different times.

Arsenic in small doses is a vital stimulant, and may be prescribed advantageously in cases of enfeebled nutrition, and when a patient suffers from nervous rigors or intermittent shiverings. In strumous and tubercular complications the use of arsenic—one or two drops of Fowler's solution at a dose, and repeated three or four times every other day—is beneficial.

Ophthalmic diseases are not unfrequently complicated with miasmatic difficulties, therefore quinine becomes indispensable as a remedial agent.

It is not pretended that every remedy of value in the treat-

ment of eye affections has been named. A few of the more prominent are introduced at present in a general manner, and others may be mentioned when special diseases are under consideration.

INSTRUMENTS.

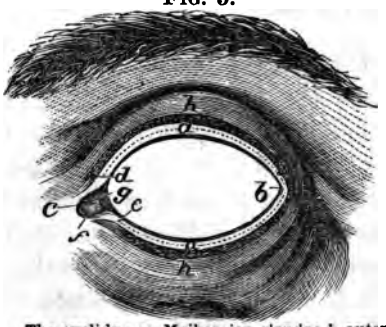
No branch of surgery demands so great a variety of instruments as ophthalmic practice; and the ingenuity manifested in devising instruments is only matched by the skill displayed in their construction and elaboration. An oculist's ordinary operating case contains from twenty to a hundred different instruments, and an eminent specialist may possess a thousand separate instruments. Many instruments are so delicate that they ought not to be used but a few times. The edges or points become impaired by moderate usage, and they will not bear resharpening. Not a few oculists exhibit a preference for instruments of a particular workmanship, or for those of fancy forms and shapes, consequently an attempt to describe a hundredth part of all the instruments employed in ophthalmic surgery, would occupy more space than can be afforded in a work of this character.

The beginner in surgery can get along quite well with an operating case which contains instruments for the different cataract operations, for executing iridectomy in several ways, for overcoming strabismus, for removing pterygium, for treating the lachrymal apparatus, and for correcting defects of the lids. Liebreich's ophthalmoscope, or one of some other pattern, is needed, several lenses of different magnifying powers, a variety of spring speculums for holding the lids apart, forceps of various kinds, including one with a plate and ring to be used in removing small tumors of the lids. Test types, spectacles, eye-bandages, shades, artificial eyes, and many other implements and appliances go to make up the oculist's *armamentarium*.

THE LIDS AND THEIR DISEASES.

The eyelids are two curtains which shield the deeper ocular structures, and have the power of winking. They have a delicate dermic covering without, and a conjunctival lining within. Their free margins bound the palpebral fissure, which terminates outwardly in an acute angle (external canthus), and inwardly in an obtuse angle (internal canthus). The tarsal cartilages, which are crescentic in form, constitute firm attachments for the softer structures, and serve the purpose of semicircular hoops at the mouth of a bag or net. On the dermal edge of the free borders of the lids are rows of glossy and curved hairs, called lashes or cilia, which, besides being ornamental, serve to protect the conjunctival surfaces from motes and irritating substances. The lids have a broad, thin and pale muscular layer, the fibres sweeping semicircularly in each lid beneath the thin integument, and uniting in the palpebral ligaments at either canthus. This muscle is called the orbicularis palpebrarum, and is efficient in closing the lids. The upper lid has, besides, a long slender muscle (No. 4, in Fig. 1), which lifts the lid and holds the eye wide open.

FIG. 5.



The eyelids: *aa*, Meibomian glands; *b*, outer canthus; *c*, inner canthus; *d*, lachrymal 'punctum' of uppper lid; *e*, punctum of lower lid; *f*, lachrymel caruncle, *g*, semilunar fold in locus lachrymalis; *h*, orifices of plucked eyelashes.

A fascia underlies the muscles of the lids and extends to the rim of the orbit. This is densest in the median line terminating at either canthus, and constitutes with the tendonous bands of the orbicularis muscle, the palpebral ligaments. The inner extremities of the tarsal cartilages are held in place by the internal palpebral ligament, and moved inwards or buried in the lachrymal fossa by bundles of muscular fibres denominated Horner's muscle, indicated by H, in Fig. 6.

The tarsal cartilages have a set of sinuous tubes opening upon their free margins. These are the outlets of the Meibomian glands which secrete sebaceous matter to lubricate the free borders of the lids.

The muscles of the lids are to some extent involuntary; and move with great rapidity when the eye is to be shielded from a sudden flash of light or a flying missile.

The connective tissue of the lids is loose and liable to infiltration, but it will not admit of fatty deposits.

FIG. 6.

H indicates Horner's muscle.

Erysipelas of the face is likely to extend to the lids, and result in abscesses. It is no uncommon occurrence for the lids to swell during erysipelatous attacks, and keep closed for several days. The structures, as has already been stated, are susceptible of infiltrations, therefore a suppurative condition is not always to be avoided when the inflammation is active or acute.

Abscess of the lids is to be treated with evaporative and anodyne lotions, if the avoidance of suppuration is desirable. But it is frequently impossible to prevent suppuration, consequently in cases threatening that state, it is good practice to employ warmth and moisture, and thus attempt to force the suppurative issue as rapidly as possible.

As soon as it be ascertained that a mature abscess exists, the pus should be evacuated through an incision made parallel to the course of the muscular fibres of the orbicularis palpebrarum. When the incision is made the thickness of the lid should be considered, that parts beneath may escape injury.

The after treatment consists in keeping the walls of the abscess in contact by means of gentle pressure maintained with a compress and a flannel or elastic bandage.

Injuries of the lids often result rapidly in a "black eye," the extravasated blood showing through the thin integument, producing a condition termed ecchymosis. Discoloration about the eyes so often follows pugilistic encounters, that a person

with a "black eye" demands immediate relief from the often disreputable marks.

Leeches have been a popular remedy for ecchymosis about the eyes, yet it is now known that the creatures will not suck extravasated blood, but only that which is circulating in the vessels. In fact, leech-bites in loose tissues are followed by ecchymosis.

A piece of raw beef is another popular remedy for the eradication of "black eye," but the cataplasm of flesh rarely gives satisfaction to the impatient sufferer.

A contused eye which is black at first, soon passes through several hues, assuming at length a greenish tint, and finally a lemon color.

It is well to apply to a recently bruised lid a dilute tincture of arnica, aconite, and other agents of that class. Such lotions prove sedative to irritated nerves, and seem to promote disintegration of the extravasated blood, and its removal by absorption.

The best way to hide the discoloration is to cover the ecchymosed region with flesh colored adhesive strips.

Incised and lacerated wounds of the lids are to be treated according to those principles in surgery which pertain to traumatic states in other regions of the body. Sutures are to be avoided when practicable, though they are sometimes essential to an efficient and judicious dressing. Linear cicatrices, when they take a direction parallel to the course of the orbicularis palpebrarum muscle, readily fall into a wrinkle, and thus escape observation.

Œdema of the lids is not a distinct affection, but generally depends upon disease of the bones of the orbit, or of the nasal structures. The use of arsenic in poisonous doses will produce a puffy appearance of the lids; and Bright's disease of the kidneys, as well as other complaints of an exhausting character, are accompanied with swelling of the lids. A removal of the cause of the œdema when it can be accomplished, is the rational way to get rid of the swelling.

Emphysema of the lids, like ecchymosis, is usually the result of a blow, but air from the nasal cavities gets into the loose tissues instead of blood. Necrosis of the thin bones in the vicinity of the orbit, establishing communications with the ethmoid cells or frontal sinus, is a common cause of

emphysema around the eyes. After fractures about the nose and orbits, and following ulcerative diseases of the bones alluded to, the patient can often make the lids puffy with air by "blowing the nose," or by closing the lips and nostrils, and distending the mouth and nose with air from the lungs. The emphysema is not a grave complication. Following fracture, it soon subsides; but if produced by ulcerative conditions, the cure will depend much upon the continuance of the cause.

Warts occasionally develop upon the lids, and prove obstinate sources of annoyance. They are not essentially different in nature from excrescences of the kind on other parts of the body. If they grow upon the edges of the lids they can not well be attacked with caustics. Excision is an efficient method of destroying warts, whether located on the lids or other parts of the body. Evulsion with forceps may do, though if a "seed"—centre of evolution—be left behind, a reproduction of the excrescence may be expected.

Congenital vascular tumors—*nævi materni*, or "mothers' marks"—are not uncommon deformities of the lids. The vascular capillaries seem to be in an aneurismal state, enlarging and discoloring the part affected. If the enlarged vessels be arterial in nature the tumor or excrescence will be pulsatile and of a light red hue, but if they be venous a livid tint prevails. These tumors usually remain stationary, or enlarge *pari passu* with the growth of the child, but they may develop rapidly and demand operative interference to check their growth.

The treatment of these vascular excrescences does not differ from that applicable to the disease located in other parts of the body. "Monsel's Solution," a ferruginous preparation, is a valuable agent to constringe and eradicate nævi. If apparently too strong, it may be reduced by adding an equal quantity of glycerine. Carbolic acid applied at full strength, with a stick or pencil, and renewed every day or two, will often obliterate the excessive vascularity of a nævus. Caustic and astringent darts have been employed to destroy these vascular developments. And strangulation by means of a ligature thrown around needles which have been made to transfix the tumor, has brought about satisfactory results. Excision in some instances, and transplantation may be required to overcome the defect. A vascular spot of

restricted boundaries may be enclosed in a "ring forceps" to isolate the parent vessels, then, after slitting the mass with a delicate knife, the incisions may be filled with tannic acid. If the forceps be left in place a few minutes no bleeding will occur. A small slough obliterates the original disease, and only a small cicatrix remains.

Cysts in the integument of the lids, or below the brows near the nasal region, are not uncommon. Their contents may be sebaceous, oleaginous, or melicerous. An oily cyst, situated near the angular processes of the frontal bone, may contain hairs. This strange state of things is explained by supposing that one or more hair follicles have become inverted or so changed in their function that the capillary product is turned loose into the cavity of the sac. These cysts in or about the lids rarely produce discoloration, or inconvenience. But being conspicuous, their removal is desirable. Often they are not larger than a pea, yet by irritation they may inflame, suppurate, and discharge, and thus disappear. Cysts just beneath the integument should be excised; and if the excision embrace the entire sac there need be no fear of a return of the disease. Cysts the size of a pin's head need not be treated, as they are too insignificant to command attention.

FIG. 7.

Cystic tumor of the lower lid.

Cysts projecting on the inside of the lid, and producing conjunctival irritation, may be destroyed by everting the lid, incising the sac to evacuate its contents, and cauterizing the cavity with carbolic acid or other escharotic introduced with a pencil of wood. No caustic need be used if the sac be entirely dissected out.

Carcinoma and epithelioma near the palpebral border may be removed by excising a wedge-shaped piece of the lid, including the cancerous or suspicious growth, and then uniting the edges of the wound with sutures. Epithelial cancer usually attacks the skin near the lachrymal sac, and extends towards the bridge of the nose as a shallow, pale ulcer. This form of the disease may commonly be removed, if it has not reached the deeper structures, by the use of the chloride of zinc paste.

The graver forms of carcinoma involving the lids, rarely yield to treatment.

ECZEMATOUS PUSTULES ON THE BORDERS OF THE LIDS.—It is common to observe one or more pustules on the outer edges of the lids. The roots of the cilia and the minute glands around them seem to be involved in the affection. At first a nodule arises, which after showing signs of inflammatory action for a day or two, suppurates. The latter action loosens several lashes, and the pus escapes through the openings left by the displaced cilia. The pustules range in size, from a hemp-seed to a pea.

The irritation accompanying the eczematous state is attended with reddening of the palpebral border and thickening of the edges of the lids. In young persons of a strumous diathesis eczema of the lids is a common way for the taint to manifest itself. The children in scrofulous families are frequently "pink-eyed," as the purplish red at the margins of the lids, is sometimes denominated. The eyelashes grow stiff, and become twisted and distorted; and a scaly eruption seems to cling to the bases of the cilia. The contorted eyelashes reach the cornea, and establish chronic inflammation of the conjunctival membrane. In time the disturbance produced by "wild hairs" may obliterate the lachrymal puncta, forcing the tears to overflow, and constituting what has been termed *lippitudo*, or "blear-eye."

The herpetic affection is often attended with burning, itching, and other annoying sensations. The difficulty in its worst form seems to be periodical, an active attack coming on from the reception of "a cold," or from an unrecognized cause, and after lasting a week or two, subsiding to an extent which promises substantial relief.

Treatment.—It is well to puncture a mature pustule, using a cataract needle or a slender knife in the operation. In many cases this is all which may be required, especially if the disease appear to be local in character. If the morbid action be persistent and paroxysmal, developing pustule after pustule, constitutional treatment is demanded.

If the disease be decidedly herpetic in appearance, a medicated cerate may be useful to allay the topical irritation and to subdue the scaly condition at the roots of the cilia. Mercurial ointments of various kinds have long been in good

repute among oculists as the fittest to overcome eczematous states of the tarsal borders, but, as has been said elsewhere, the mercurial unguents do not often answer a satisfactory purpose in the treatment of tissues as delicate as those constituting the lids. The brown citrine ointment, reduced one-half with olive oil, is the least objectionable of the mercurial ointments; and this sometimes produces too much irritation. I prefer:

℞ Simple cerate, ℥j.
Iodide of ammonium, grs. iv.
Pulv. sub. nit. bismuth, grs. x. M.

Scent with an agreeable perfume. S. Use on the edges of the eyelids with a camel's hair brush or a delicate swab.

The following is also a favorite pomade, which may be used upon pustular lids to advantage:

℞ Ung. aquæ rosæ, ℥j.
Fowler's solution, f℥ss. M.

S. Apply to the palpebral borders morning and evening.

Many other salves may do as well. Every practitioner has a recipe for an unguent which is held in high esteem.

Obstinate cases of *eczema tarsi* can not be substantially cured without a prolonged course of "alterative" medication. And the ordinary syrups of stillingia and sarsaparilla are not very efficient remedies. The iodides of potassium and ammonium make more pronounced impressions; sulphur given in broken doses every few days, is an alterative worth mentioning; phosphorus, when administered in safe and reliable forms, is valuable; iron, dissolved in nitric acid, and administered in a dilute form, is a useful alterative; cod liver oil is known to be an efficient agent, but it is rarely offered in a palatable form; arsenic is a favorite on account of its efficacy in small doses. A common prescription of mine is the following:

℞ Peppermint water, f℥iv.
Iodide of ammonium, ℥ii. M.

S. Teaspoonful four times a day.

Iodoform, in grain doses, sugar coated, is an excellent alterative, and may be given as one of a series of remedies constituting a systemic course. No remedy should be continued more than a week without alternation with some other potent medicine.

A mixture of sulphur and sulphate of magnesia, with a

stomachic, is sometimes more desirable than the common character of the agents might promise. I make extensive use of the following prescription:

℞ Pulv. crab orchard salts, ℥iij.
Pulv. sulphur, ℥j.
Pulv. cubebs, ℥ss. M.

S. Quarter of a teaspoonful in half a wine-glass of water, four times a day, every other day—alternating with some of the other agents already mentioned.

PHTHEIRIASIS, "crab-lice," must not be overlooked in the consideration of eyelash affections. Although crab-lice have an affinity for the pudendal region, they will live about the cilia and supercilia. Inspection with a pocket lens will generally discover the presence of the parasites. Cod liver oil pencilled upon the lashes and edges of the lids every day for a week, or until all the ova are hatched, will ensure a riddance of the pests. Any of the mercurial ointments will destroy the parasites.

HORDEOLUM, or "sty," is a pustule or minute boil, which is not essentially different from those which arise in the course of an eczematous disease of the lids. A sty has its origin in one of the tarsal glands, and develops into a small abscess. Several days may be consumed in the evolution of the pustule. It begins to attract attention when the size of a pin's head, and becomes a painful nodule when the magnitude of a pea is attained. The inflammation is sometimes quite active, and extends to the conjunctiva and lachrymal apparatus. In fact, the entire eye may sympathize in the morbid action.

A sty usually reaches maturity in a few days from its commencement, and then, after suppurating for a day or two, disappears quite rapidly. In rare instances, a hordeolum forms slowly, and continues for months in an inactive state. In fact, a sty may remain in a permanent form (chalazion), or as a non-inflammatory tumor. Hordeola are apt to recur, or return after a period of subsidence or repose. Indeed, any gland which has once been inflamed, is more likely to be subsequently attacked. If a Meibomian follicle once develops a sty, it is prone to repeat the morbid action.

Treatment.—A sty is often too unimportant to demand treatment, yet in severe forms of the disease a compress of

lint and an elastic bandage should be used, and a dilute tincture of arnica or aconite may be employed to wet the dressing. Poultices are comfortable, but, if employed, they should be changed often to avoid ferments. As soon as the pustule "points" or shows that suppuration has taken place, it should be punctured or incised to allow an escape for the pus. Stys frequently evacuate their contents spontaneously, no surgical interference being necessary.

If a chalazion resist the action of medicated cerates, the little tumor may be incised to provoke suppuration and resolution. If this course should fail, the indurated mass may be excised.

EPICANTHUS is a defect arising from a redundancy of skin at the inner corner of each eye, or too much integument between the eyes. The redundant skin partly or wholly covers the caruncle, and gives to the face a Chinese expression. Associated with this defect is apt to be a depressed condition of the nasal bones at the bridge, and other defects in the features of the face. Many young children have a redundancy of skin between the eyes, but a subsequent development of the bones of the nose and face distends the loose integument, and overcomes the infantile defect.

If the redundancy continue till after puberty, it may be corrected by excising an eliptical piece of skin at the bridge of the nose, and closing the wound with silver sutures. The excision should be so performed that the line of union may be parallel to the course of the nose, and occupy the middle course. The cicatrix will thus be too slight to be observed. The operator is to judge how much integument is to be removed to overcome the defect.

It is best to cut through the skin perpendicularly with a scalpel; and the incision should extend around the piece of integument to be removed. After the piece is dissected out, the integument on each side of the chasm should be loosened by means of a few undercuts with the knife. The separation from the subcutaneous tissues allows the flaps to slide freely, and obviates tension upon the sutures. The borders of the wound are then to be joined by three silver sutures, and supported with strips of adhesive plaster.

In five or six days the sutures can be removed, yet the adhesive strips may be continued a few days longer. If

enough integument has not been removed to remedy the defect, another eliptical piece of skin may be removed, and the wound treated as just indicated.

PTOSIS, or drooping of the upper lid, may exist in various degrees of deformity, and depend upon a variety of causes. Complete inability to raise the margin of the lid above the axis of vision is rare, but a moderate falling of one lid is common. The defect generally depends upon paralysis of the levator palpebræ muscle, though it may come from defective nutrition in the muscle itself. Ptosis may occur from swelling of the upper palpebral fold, it being difficult to raise the thickened lid. Whatever be the cause, patients with this defect have feeble power to move the lid except by calling into action the occipito-frontalis; and the forehead becomes furrowed by the forced efforts of that muscle.

Attempts to remedy ptosis have generally failed. The hypodermic use of strychnia has been reported as proving serviceable, yet the relief, as under electro-galvanism, is only temporary. Surgeons have drawn down the occipito-frontalis through a subcutaneous incision, and endeavored to join the muscle to the under surface of the integument of the lid, but their success has not been such as to commend a repetition of the operation. A patient of mine, having an excessive degree of drooping in one lid, uses a strip of adhesive plaster to elevate the lid when he wishes to hide the deformity.

TWITCHING of a few fibres of muscle in the lower lid, is a source of annoyance, and may exist for years without any known cause. Nervous and neuralgic states are thought to favor it, and these conditions may depend upon stomachic, intestinal, or other disorders. It has been observed that mental excitement, and the employment of certain muscles, as in the act of whistling, will temporarily arrest the twitching. The orbicularis muscle may become spasmodic in parts or in individual bundles, causing a peculiar tremulousness, or rapid variation in winking (*nictitation*) which is exceedingly unpleasant. Pressure upon some of the ramifications of the trifacial may afford temporary relief; and, if the irregular movements depend upon habit, an interruption may prove the first step in the cure.

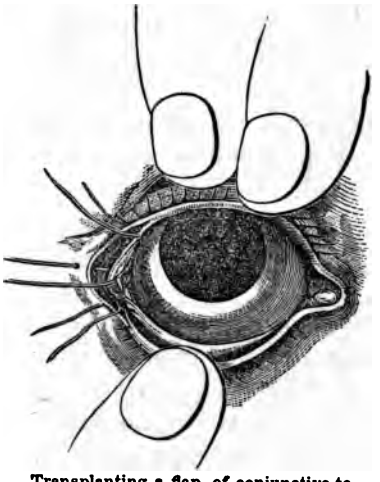
Tonics and laxatives have exercised an influence which arrested the twitching in several cases coming under my observation.

ANKYLOBLEPHARON.—Adhesion of the edges of the lids—a difficulty which bears the above technical term—arises from inflammatory action. The union commonly begins at the commissures or canthi, and sometimes extends until it has entirely obliterated the palpebral fissure. Occasionally a junction of the borders of the lids is complicated with a shortening or contraction of the tarsal cartilages, and then the defect is called blepharophimosis.

Cicatrizations from burns, injuries, ulcerations, cauterizations and ophthalmia tarsi, are the common causes of ankyloblepharon.

The defect is overcome by cutting the tarsal borders apart with scissors, or with a bistoury used along a grooved director. Frequently the union is not complete, but the edges of the lids are held near each other by adventitious bands; and these may be removed by separating their points of attachment with scissors. After separation the lids are to be kept apart by means of adhesive strips which may be so applied as to pull in opposite directions.

FIG. 8.



Transplanting a flap of conjunctiva to the traumatic surfaces of a divided outer canthus, for the cure of partial ankyloblepharon.

The adhesion when partial is commonly at the external canthus. If this be sufficiently annoying to warrant an operation, it may be overcome by cutting through the outer canthus with scissors, on a line with the palpebral fissure, the incision being to the extent of a half inch or so, and then preventing re-union by fastening with sutures a flap of conjunctiva into the wound thus made. A fold of conjunctiva is raised and so cut with scissors as to form a suitable flap to come between the tarsal cartilages. The incised edges of the conjunctival flap are held against the

traumatic surfaces of the integument by means of three sutures, one at the extreme angle of the wound, and one for each lid near the original canthus. There is plenty of conjunctival membrane in the palpebral sinus to construct the flap. This operation is a species of canthoplasty which may be easily performed.

Complete ankyloblepharon is rare, and difficult to cure. Though the palpebral fissure may be re-established, the disposition to re-unite is very great, especially at the angles of the wound.

SYMBLEPHARON, or adhesion of the lids to the globe, is produced by suppurative inflammation of the conjunctiva in the palpebral sinuses, and cicatrizations following burns, ulcers, and the injudicious use of caustics. Trachoma—granular lids—is sometimes followed by adhesive connection between the lids and eyeball. The union is rarely complete, the lachrymal secretion obviating a total blending of the structures resting in contact. Adventitious bands frequently connect the under surface of a lid to the cornea or scleral border. If the adhesion extend to a considerable portion of the cornea, vision is irreparably lost. An adventitious band is frequently hour-glass in shape, slender or contracted in the middle and broad at each base.

Treatment.—An eye that has recently been injured with quicklime, strong acids or alkalies, or hot substances explosively hurled between the lids, should receive careful attention to prevent, if possible, symblepharon. The lid may be pulled away from the globe every few minutes; and the patient ought to be encouraged to roll the eye, motion serving to interfere with adhesive action. Granulating surfaces should be lightly touched with a sulphate of copper pencil. If the ulcerated surfaces be extensive the upper lid may be kept everted. It is not easy to keep the lower lid in a state of eversion without dividing the external commissure, a procedure which may be justifiable in bad cases.

An adventitious band connecting the lid with the cornea may be clipped and turned away from the point of separation. This allows the traumatic surfaces to heal separately. The entire band may then be snipped off without endangering re-adhesion. If the neoplastic band be short and broad, there is danger of re-union unless the lid be kept everted. A

band extending to the bottom of the palpebral sinus should be dissected out; and then the lid is to be kept in a state of eversion until the tendency to re-union has passed. To make sure of a good result the conjunctival fissure can be closed with sutures.

When the removal of cicatricial tissue produces an extensive traumatic surface, a re-union can be prevented by the patient's wearing a leaden disc shaped somewhat like an artificial eye.

DISTICHIASIS AND TRICHIASIS.—By *distichiasis* is understood the existence of *a double row of lashes*, though scattered hairs, and those which stand irregularly, bear the same name. It is rarely or never that an additional row of hairs exists, but straggling cilia coil inwards, and irritate the cornea, causing excessive vascularity and haziness of that body. A calloused and cicatrized border to the lid tends to spread and distort the cilia.

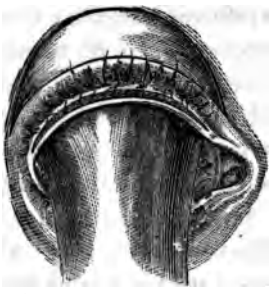
By *trichiasis* is understood an inversion of the lashes, or a bending inwards of the cilia. In trichiasis, there is an irregularity in the size of the hairs, a large one may be associated with several small ones; and what had been a single follicle will send out three or four diminutive cilia, which will crinkle or spread in different directions. These "wild-hairs," as they are sometimes called, frequently give a great deal of trouble, eventuating in serious disorder of the cornea and loss of vision.

Treatment.—Depilation is the old treatment for distichiasis and trichiasis. Cilia forceps, the blades of which are so ground and adjusted as not to cut the lash which is seized, are employed in the removal. The plucking process must be repeated every few days, as new hairs rapidly grow from the old follicles. Each offending hair should be firmly grasped near its base, and extracted with a slow steady pull. The fine hairs may escape detection unless the lid be scrutinized with a magnifier. After repeated depilation for weeks and months the hairs begin to grow more slowly and sparingly. At first it may be necessary to extract the distorted cilia every day or two, but at length intervals of weeks may elapse without the lashes receiving attention.

Operative measures of different kinds have been devised to take the place of depilation which is tedious and uncertain.

One of the methods calls for a splitting of the lid, say the upper, while the patient is under the influence of an anæsthetic. A horn spatula pushed into the palpebral sinus, serves to distend and support the lid while it is being split. An assistant is required to draw up the parts as they are loosened by the dissection, and to steady the spatula. The operator must be careful to include all the cilia, embracing their bulbs, in the outside flap. If a hair follicle be left in the tarsal and under flap, a lash will be reproduced which may renew the trouble. The split in the lid should be a quarter of an inch deep, and not extend into the punctum lachrymalis. A second incision parallel with the first, yet in the integument behind the cilia, and extending a little beyond the boundaries of the first incision, isolates a belt of lid bearing the cilia, except at its extremities which are expected to furnish vascular supplies. A third incision is next made by beginning at one of the extremities of the second incision and after being carried in a semicircular sweep over the rotundity of the lid, terminates at the other extremity of the second incision. The crescentic piece of integument thus surrounded with incisions is to be dissected out, and the border of the cilia-bearing flap is to be stitched to the edge of the wound made by the third incision. In three or four days the sutures may be taken out and the healing process left to itself. This operation will compel the cilia to take a higher range, and keep clear away from the parts within the palpebral fissure.

FIG. 9.

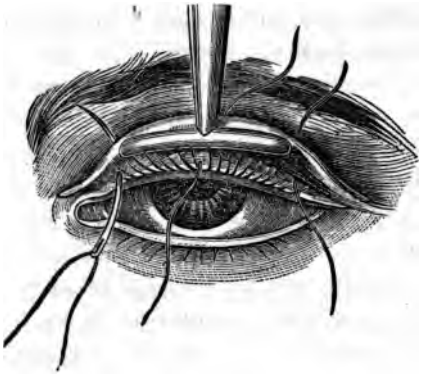


This diagram represents a spatula beneath the upper lid, to act as a support to the loose tissues while the lid is being split and otherwise incised.

Graefe has modified this operation by first making two vertical incisions through the skin and orbicularis muscle, and then splitting the lid as in the operation just described. The punctum should not be disturbed in the operation. After this flap is made, which contains the cilia, an oval piece of palpebral integument may be pinched up with the crutch-shaped forceps, and excised with scissors. The edges of this last wound are to be drawn together with sutures. This part of the operation elevates the flap bearing the cilia,

carrying them away from sensitive parts within the palpebral fissure. This method of removing trichiasis is applicable to the upper lid. The disordered hair follicles may be dissected from the lower lid without having the result observable as a defect.

FIG. 10.

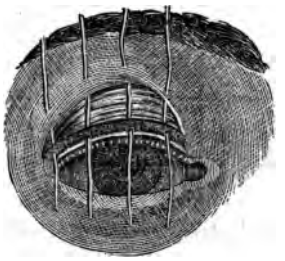


Crutch-shaped forceps grasping an oval mass of integument which is to be excised.

Stellwag remarks that "success is by no means assured either by one method or the other, although they may be carried out with the greatest precision and care."

Fortunately, not all cases of trichiasis embrace the entire cilia, but the difficulty is restricted to a short space near the inner or outer canthus, or to a spot near the middle of the lid. For the removal of a few distorted cilia, confined to a space a third of an inch in length, the following process may be followed: A spatula is used to put the tarsal border on the stretch, then a lance, spear, or spade-shaped knife is employed to split the lid to the extent of the width of the blade, and the incision may be extended if necessary, with a small scalpel. The triangular flap thus raised is removed with scissors, and the edges of the wound closed with sutures. This procedure gets rid of the offending hairs and their follicles.

FIG. 11.



Lid split, and oval mass excised; the sutures will draw upward the strip of lid which contains the cilia.

If the trichiasis be confined to a narrow space on either lid near the outer canthus, the same lance-shaped knife may be used to under-cut the flap bearing the distorted hairs, an inverted **A**-shaped incision removes the flap, and sutures approximate the edges of the last incisions, overcoming the defect.

As the inner extremities of the lids contain the puncta, the operation near the internal canthus, when required, must be

conducted with reference to those points. Trichiasis does not so often affect the hairs near the inner canthus as it does the cilia near the outer commissure of the lids.

It has been found that the removal of a triangular piece bearing distorted cilia, is followed by relapses, the hairs adjacent to the wound being drawn inwards by the contracting cicatrix, therefore a sort of transplantation of the neighboring part of the outer lips of the split lid should sometimes be combined with the excision. The incision dividing the lid into two layers, may be extended on either side to the distance of one or two lines beyond the base of the inverted cilia. Then, if the distorted lashes affect a spot near the middle of the lid, a triangular flap, with its apex wanting and its base up on the lid, is to be marked out by an incision to the depth of the outer layer of the split lid, and dissected from its place. The two under-cut tips are to be united with a suture, and affixed above to the integument which bounds the base of the triangle near the angles.

FIG. 12.

This diagram represents the operation of splitting a lid.

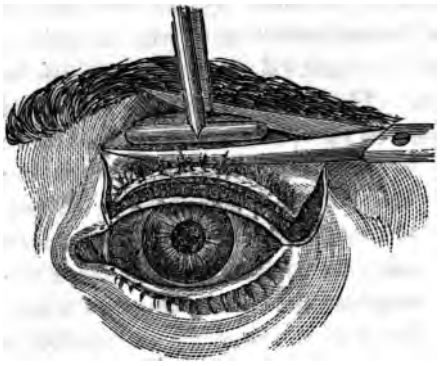
Substantially the same operation may be performed near the outer canthus, even involving the commissure and parts of both lids, the shape of the pieces cut around and dissected out, being modified in accordance with the defect to be overcome.

If a case occur in which transplantation is unsuccessful or is impracticable from cicatrizations, it may be best to entirely remove—after the lid has been split—the narrow strip bearing the distorted cilia. This creates a deformity, which, however, is preferable to seriously impaired vision.

Operations upon the lids require considerable skill in their performance; and the degree of success depends much upon the plan of cure adopted. Only a few general rules of treatment can be laid down. The operator of moderate experience must study each case demanding surgical interference, and apply intelligently these broad principles, bearing in mind that two cases in surgery rarely accord in every particular.

No inflexible direction for an operative procedure can be expected to reach a variety of palpebral defects and deformities. In the event of doubt in regard to the propriety of applying a certain method of operating in a given case, time and thought should be devoted to a consideration of so important a subject. The most experienced operators do not hastily engage in the execution of a means of cure until every important point in particular cases has been deliberately weighed and decided upon. Every plastic operation needs special consideration.

FIG. 13.



This diagram represents the lid as having been split, and vertical incisions made. An oval piece is being excised from the loosened flap which is to undergo some degree of transplantation.

ENTROPION.—The terms *entropion* and *ectropion* are respectively applied to the *inversion* and *eversion* of the margins of the lids.

Entropion generally affects the lower lids of one or both eyes, the upper lids being nearly exempt from the disease. In the severer phases of the difficulty the border of the lid is completely inverted, the cartilage itself being rolled over, so that the cilia and the integument rub against the globe.

Entropion is frequently produced in children by irritable forms of general ophthalmia, the orbicularis muscle being kept in a prolonged state of rigid contraction or spasm. In old subjects with wrinkled and relaxed skins, and irritable orbicularis muscles, entropion is not uncommon.

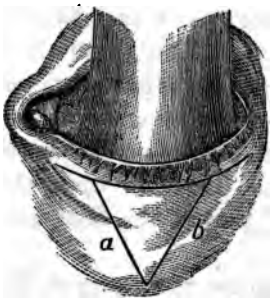
The improper use of caustics in the treatment of trachoma, and the accidental introduction of lime, acids, and heated substances within the palpebral fissure, have been followed by entropion of either lid.

Treatment.—Contractile collodion painted upon the integument of the inverted lid, may be all the treatment needed in mild forms of the defect. But, in the more serious aspects of the disease, some kind of an operation is necessary to affect a cure. If the entropion depend upon contraction of the

orbicularis, a division of the external commissure affords substantial relief. The incision should not be made horizontally, as if to extend the palpebral fissure, but obliquely downwards, when the under lid is affected. A canthoplastic operation may be requisite to overcome entropion depending upon spasm or rigid contraction of the orbicularis. And, in addition, if the inversion be confined to the outer third of the lid, an eliptical piece of integument may be dissected from the lid just below the cilia and the wound united with delicate sutures. The peculiarities of some cases require compound operations. Another operative method of treating entropion is to seize a horizontal fold of integument with a crutch-shaped forceps, as represented in Fig. 10, and after transfixing the fold at its base with three ligatures, their ends are tied. In favorable cases, the inflammation is only sufficient to produce adhesion of the inner structures of the fold, which serves to contract the integument and evert the edge of the lid.

Vertical tension is exercised by the raising of a fold and fixing it with ligatures, but horizontal tension may be more effectual in some cases of entropion. This may be obtained by dissecting a triangular fold from the lid, and joining the right and left edges, *a* and *b*, of the wound with sutures. The operation is performed by introducing a horn-spatula into the lower palpebral sinus, and then making an incision horizontally, just below the cilia, to the depth of the integument, and extending within two lines of each canthus. The triangle is completed by two other incisions beginning at the horizontal incision, a third of an inch apart, and converging at a point a half inch from the base line. The horizontal incision is left to heal without sutures.

FIG. 14.



This diagram represents a method of curing entropion by excising a triangular flap of integument, from the lower lid, and closing the wound by joining the walls *a* and *b* with sutures.

Several other operations have been devised to cure entropion, but none seem to possess advantages over those just described.

ECTROPION.—The lower lid, wholly or in part, is liable to become morbidly everted; and the upper lid is not exempt

from the defect. There are several degrees of ectropion, the mildest being an appreciable everson which may not interfere with the functions of the eye; in a graver stage the palpebral conjunctiva is exposed to disturbing influences from without and may be quite unsightly; and in the worst forms the lid is totally everted.

The changed position of the free margins of the lids interferes with the free and proper escape of the lachrymal secretion. The tears collect in the lower palpebral sinus which is widened by the lid falling away from the globe, and give the eye a suffused appearance. The overflowing tears excoriate the cheek, and, as a consequence, there is a shrinking of the integument and an increase in the degree of ectropion. Motes falling upon the exposed conjunctival surfaces, produce irritation, inflammation, hypertrophy, and induration of the lids, besides distortion of the lachrymal outlets.

In isolated cases weakness and paralysis of the orbicularis muscle have been assigned as the cause of ectropion, especially in old people who have suffered with conjunctival catarrh. It is then called *senile ectropion*. At first the lachrymal punctum becomes everted, then the overflow of tears leads to shrinkage of the palpebral integument, and, finally, the lid becomes completely everted, the flesh-like conjunctiva swells, and appears roughened from trachomatous granulations.

Shortening of the integument by contracting cicatrices following burns, wounds, and losses of substance, produces some of the worst degrees of ectropion. Traction upon the integument from large cicatrices on any part of the face, and even on the neck, may cause ectropion.

Treatment. A properly adjusted compress resting upon the elongated and everted lid, and supported by a bandage, is often sufficient to cure ectropion.

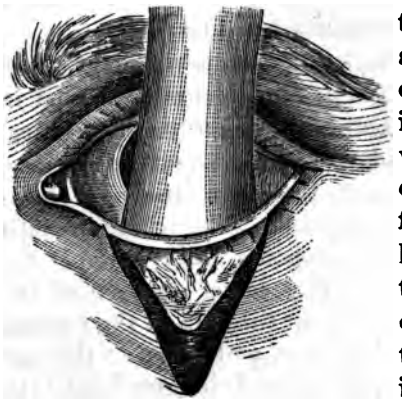
If the palpebral fissure be narrowed and shortened by paring the edges of the lids near to and including the commissures, and uniting these freshened surfaces with sutures, the eversion may be relieved. Narrowing of the fissure often improves the patient's appearance by masking the actual or apparent prominence of the eyeball.

"In ectropion of the lower lid, caused by elongation of the free border, with distention and relaxation of the cartilage, which can not be completely relieved, the lid must be rendered

tense in a horizontal direction, and at the same time lifted up, if we hope to have it fit the eyeball again. The simple narrowing of the palpebral fissure has almost always shown itself to be insufficient.

"If it be accompanied by no very great shortening of the integument, and if the margin of the lid is in other respects normal, the excision of a triangular flap, from the outer portion of the lid, and closing the wound with sutures, is generally sufficient. For this purpose the edges of the lids in the outer commissure are split with an irridectomy-knife, the splitting being continued, if necessary, with a scalpel. Then a triangular flap of integument is made by the converging incisions, which is dissected up from the tissue beneath. The edges of the wound are then united by suture, and a protective bandage applied until adhesion has occured. In order to lessen the stretching, it is well, before closing the wound, to separate the inner edge from the tissue beneath for a little distance, particularly if the subcutaneous tissue be somewhat thickened from previous irritations, and likely to resist the intended pressing out of the integument. It also seems advisable to somewhat diminish the tension by keeping the adjacent parts drawn towards the cicatrix by strips of plaster. If we wish to secure a great elevation of the lid and of the commissure, the *tarsoraphic* operation deserves the preference. (*Ammon, Graefe.*) Before this operation is undertaken we should close the lids, bring the lower one into a normal position, then the border is put slightly on the stretch in a horizontal direction. We should then mark with ink, in a vertical line, the two points of both the edges of the lids, where both lid-margins fit each other, when they are in a normal position, and there is a slight amount of tension of the lower lid. Then, the lids being kept in the position

FIG. 15.



Ectropion of lower lid treated by dissecting up a triangular flap, and joining the edges of the wound to one another and to the elevated flap, sutures being employed.

described, the integument over the outer commissure is lifted up in a horizontal fold, and as much of the integument of the lower lid very gradually fastened between the fingers as is necessary to bring the lid into its normal position, and to elevate the outer commissure to the level of the inner angle. When the breadth of this horizontal fold of integument is also indicated by two lines parallel to the margin of the lid, we begin to extirpate the portion of the integument within the described boundaries.

"While one assistant holds the head of the patient, and another restrains the bleeding, the operator (see Fig. 15,) pushes a small horn-spatula under the outer commissure, lifts it up from the globe, and splits it into two layers, first thrusting in a broad, lance-shaped knife immediately in front of the fascia tarso-orbitalis, and then enlarging the wound with a scalpel on both lids, up to the vertical boundary line.

"When this intra-marginal splitting is done sufficiently, the lower and then the upper margin of the lid are freshened in a direction inward from the vertical boundary line for about one-half to three-quarters of a line, by a horizontal incision. The whole breadth of this incision falls behind the lashes. The lower margin of the lid is now cut through in the vertical boundary line, and down to the cartilage, the wound elongated until the level of the horizontal line has been reached. The knife is then turned in an obtuse angle looking outward, carried on parallel to the margin of the lid, and beyond the commissure is turned upward in the shape of an arch.

FIG. 16.

Triangular flap dissected from outer canthus and lower lid. The closing of the wound as seen in next figure, draws the under lid upward and cures the ectropion.

"The upper lid is treated in the same way. The horizontal incision is to be made at a greater or less distance from the edge of the lid, according as the outer commissure is to be more or less elevated; but it should always be so made that the two run together at an acute angle. The integument thus circumscribed is dissected up, and the wound closed by three or four sutures. The first suture is placed close to the

vertical boundary line. When all are inserted, the curved incision is changed to a horizontal one.

"In order to lessen the tension, strips of adhesive plaster, as well as the protective bandage, may be used. These are fastened on the cheeks and forehead, and draw up the integument which is between them.

"When there is a very great difference in the length of the edges of the lids, the result of the operation is endangered by the bulging forward of a large fold of the cartilage and the fascia under the suture. It is, therefore, advisable, after the separation of the circumscribed flap, to cut out a piece or gusset (*Zwickel*) next to the outer commissure, whose axis runs outward and somewhat downward, and whose base is about the same size as the difference in the length of the edges of the lids. The edges of the incision in the cartilage and the fascia should then be included in the suture." (*Stellwag.*)

FIG. 17.

The completion of the operation represented as commenced in the diagram immediately preceding this.

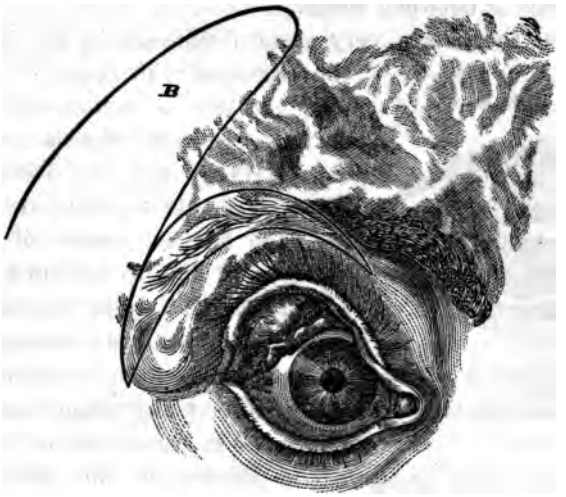
The excision of a V-shaped piece from the edge of the lid, with the purpose of shortening the palpebral border, rarely results in a satisfactory cure, because the outer commissure is not elevated by the operation.

Attempts to relieve ectropion by the destruction of the palpebral fold with caustics, are often worse than useless.

The worst cases of ectropion arise from the cicatrices of burns, and can only be remedied by a transplanting process called blepharoplasty. One illustration will explain the principle involved; and then the ingenuity of the operator will determine how the varied deformities about the lids are to be managed. The inodular mass, everting and distorting the lid, is circumscribed by two curved, oblique incisions; then the cicatritial structure is dissected out, drawing bands in the adjacent integument under-cut, the lid stretched into its normal position, and the gaping wound closed by a flap (B) shaped like it, but somewhat longer and broader. The flap is taken from the temporal region, where the integument is free from inodular tissue, and one of its borders terminates in the incision employed to remove the cicatrix. After being

well dissected up, except at its base where vascular supplies are obtained, it is to be swung into the wound, and stitched in place. The flap should be large enough to fill the wound without the slightest stretching. The gap made by the trans-

FIG. 18.



Blepharoplasty instituted to overcome ectropion of upper lid caused by cicatrization following a burn.

planted flap is to be closed by sutures and adhesive strips. If any part remains uncovered it will fill by granulation, leaving little or no deformity.

STRABISMUS.

Strabismus, or squinting, is a defect which generally arises from an unequal distribution of power in the motor apparatus of the eye; and is manifested by a preternatural turning *in* (convergent squint), or turning *out* (divergent squint), of the organ. The distortion destroys the parallelism of the eyes' axes, and thus impairs the personal appearance of the individual. Nor is appearance alone concerned in the defect; but the function of the eye so often suffers from the physical distortion, that impaired vision results. A cure, then, involves an improvement in sight, as well as personal appearance.

Every shade or degree of squinting exists, from the half burial of the cornea in the canthus, to the slightest appre-

ciable "cast in the eye." The worst and most frequent forms of squinting are where the eye turns in, the outward variety being rare in occurrence and moderate in degree. An abnormal turning up or down of the organ, an uncommon distortion, constitutes a defect of the same nature.

Squinting is generally confined to one eye, though it may affect both. Often the squint will apparently change from one eye to the other, and the faulty organ has to be discovered by covering one eye and then the other, and observing which is most under control and least liable to deviate from the straight position. As a general thing the eye which squints the worst can be determined by its habitual appearance, and by the direction it inclines when at rest. An examination often has a disquieting effect, causing the eyes to roll, and thus tending to defeat all attempts to discover the defective organ or the degree of defect. Upon trial it will be found that one eye can be turned out more than the other, when the opposite one is closed. By reversing the experiment two or three times a correct diagnosis can be established. If the vision of one eye is known to be weaker than that of the other, it may be inferred that the one suffering from impaired vision is the organ which is strabismic.

The cause of strabismus may generally be referred to the nervous centres. The difficulty is not commonly congenital, but comes on most frequently about the period of dentition, a period well known to be fraught with danger from unequal distribution of nerve force. This is a period when intestinal derangements prevail, and convulsions spring from nervous irritation. Any disease which greatly impairs the general health, as hooping cough, measles, scarlatina, cerebro-spinal meningitis, and other disorders of early life, may so derange the nerve centres presiding over the ocular apparatus, that squinting results.

Strabismus almost of necessity comes on when corneal specks, opacity of some part of the lens, or distorted pupil, will not allow the light to reach the retina without some twisting of the eyeball. The eye under such circumstances is obliged to accommodate its position so that rays of light shall not be obstructed in their passage through the cornea, pupil, and lens.

Paralysis of the external rectus, sometimes producing diplo-

pia or double vision, is occasionally the cause of strabismus; and E. Meyer has suggested that the defect be overcome by holding the base of a prism against the temple on the affected side, so that in looking at it the rays of light shall be defracted to a spot internal to the macula lutea; then the external rectus, to correct the diplopia thus caused, would contract and slightly evert the eye, and being gently exercised in this way, day by day, would gain strength, and perhaps ultimately regain its former power.

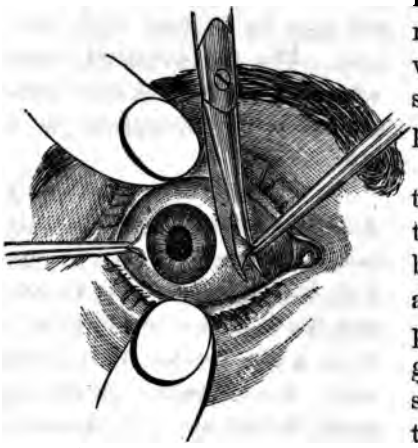
TENOTOMY.—The operation of dividing the rectus tendon on the side the eye inclines to turn, is claimed for modern surgery, its history dating back only to 1839. An itinerant boaster by the name of Taylor published a pamphlet, styled "*De vera causa strabismi*," a century earlier, and heralded his discovery through many countries of Europe. The degree of success attending his practice is not known, except that the people cried out "miracle." Why the inventions of the pretender were not heeded is not clear, but they were allowed to slumber a hundred years, before being rescued from oblivion, or the idea was re-discovered.

As soon as the operation of tenotomy was put into active practice and pronounced legitimate, strabismus of all kinds was subjected to it, no attention being given to the nature of the difficulty or its cause. The consequence was, as might be expected, that the operation was attended with failures and fell temporarily into disrepute. "But, said Prof. Mutter, "notwithstanding all that has been said and done to discredit it, I have no hesitation in declaring, that when properly performed, and the case carefully selected, (for there are many altogether unfit for the operation), it richly deserves being ranked among the most useful modern improvements in our art."

The instruments needed in an operation are a "retractor" for elevating the upper lid—(the under lid may be depressed with the little finger of the left hand while operating)— a pair of toothed forceps for raising the conjunctiva, a blunt hook for raising the rectus tendon, and a pair of curved scissors for dividing the loop of tendon which rests upon the blunt hook. The accompanying diagrams represent the entire operation.

In Fig. 19, forceps are seen holding the eyeball outwards, while a fold of conjunctiva on the inside of the eyeball is grasped with another pair of forceps and incised with scissors. Through the incision a blunt hook is carried and made to fish up the tendon of the rectus internus; and when the raised tendon appears in the wound it is divided with scissors, an act which completes the operation.

FIG. 19.



A method of incising the conjunctiva to make way for the use of the blunt hook which is to fish up the tendon that needs dividing.

The pain attendant upon the operation is not severe, though an anæsthetic may be administered to children and nervous persons. The patient sits in a chair in a good light, and an assistant steadies the head, and uses the retractor to lift the upper lid. It is as well to raise a small fold of conjunctiva and cut out a piece as it is to make a slit in the membrane. One wound will heal as quickly as the other, and neither leaves a deformity. There is not much difficulty in finding the tendon and raising it on the blunt hook; the areolar tissue and fascias may offer some resistance to the passage of the hook. Care must be taken not to split the tendon with the hook, as only a part would then be raised and cut. The sclerotic is so dense that little danger need be feared of injuring it. In a bad case, especially if the patient be an adult, a simple division of the contracted tendon is not enough to release the eye from the restraint under which it is bound, but the ocular fascia prevents the eye from assuming a position parallel with the other, therefore bundles of this fascia are to be sought with the blunt hook, and divided when found. A too free dissection should be avoided, lest the eye turn too far in the opposite direction, and present a bulging appearance..

The after-treatment is simple; the patient should be kept from a strong light for a few days, and be made to use the defective eye by covering the other with a bandage. The divided ends of the tendon will unite to the sclerotic, and thus

force may be exerted upon the eyeball. The space between the divided ends will fill with new material, and so elongate the muscle. The wound in the conjunctiva generally heals kindly, and rarely needs any treatment. Sometimes a fleshy or granular excrescence appears in the wound; and if persistent may be excised with scissors. The extravasated blood which to the patient may seem alarming, will disappear in a few days.

FIG. 20.

The upper lid lifted with a retractor, the tendon of internal rectus raised on the blunt hook, and the scissors ready to divide the tendon.

In cases of apparently double squint it is commonly best to operate upon one eye first, leaving the other to correct itself as it sometimes will. If, in a few weeks, it be found that considerable squinting exists in the eye not operated upon, this eye may be subjected to the same treatment as the first.

If the first operation do not satisfactorily overcome the deformity, another may be performed after several weeks have elapsed; even a third or fourth trial may be made.

Divergent squint is seldom operated upon, for the defect generally occurs in elderly persons who are not sensitive about mere personal appearance. However, if the operation be demanded, the operative procedure is the same as that for the relief of convergent squint, except the external rectus is divided instead of the internal.

When strabismus affects both eyes, though one more than the other, the operation upon both eyes is to be executed at the same time. In fact, cases will be found where the axes of the two eyes may not come parallel until corresponding muscles in the two eyes have been divided.

Strabismic eyes are rarely rendered perfectly straight, or entirely free from appreciable defect, by an operation. However, the remaining defect may not be noticeable, at least to the ordinary observer, therefore no dissatisfaction is expressed.

THE LACHRYMAL APPARATUS.

The lachrymal gland, constituting the secretory portion of the lachrymal apparatus, is situated in the upper and outer part of the orbit, in a digital depression formed for it in the orbital plate of the os frontis. The ducts of this gland, six to twelve in number, minute as hairs, open in a row along the under surface of the upper lid, near the outer third of the tarsal cartilage. After lubricating the conjunctival surfaces, the lachrymal fluid is directed to outlets near the inner canthus. The commencements of the conduits are called puncta; one is in the upper, and the other is in the lower lid. Each punctum is the beginning of a small canal—canaliculus—that terminates in the lachrymal sac, which is an expansion of the lachrymal apparatus and lodged in a groove which is chiefly in the lachrymal bone. The sac is the commencement of a duct—ductus ad nasum—which conveys the waste tears to the inferior meatus of the nose.

DISEASES OF THE LACHRYMAL APPARATUS.—The lachrymal gland is rarely the seat of disease. Its situation beneath the projection of the frontal bone protects it from injury; and inflammatory diseases of the eye exert merely a sympathetic influence upon it. The gland is occasionally the centre of malignant deposits; and it may suffer from ordinary hypertrophy, constituting a tumor large enough to press the eyeball downward.

The lachrymal gland may be extirpated without much trouble. An incision three-quarters of an inch in length made through the skin and fascia near the orbital rim at the upper and outer part of the orbit, furnishes a wound large enough for the finger to explore the gland and make room for its removal. Toothed forceps may be used to lift the gland from its bed, when it may be excised with scissors.

The vessels supplying the gland with blood are not large, and the pinching cut of the scissors prevents them from bleeding. In making the primary incision care must be exercised so as not to divide the supra-orbital vessels and nerves, and the levator palpebræ muscle. In other words, the incision should be entirely outside these structures. As will be

mentioned in another place, the lachrymal gland may be removed for the cure of fistula lachrymalis.

The excretory ducts of the lachrymal gland may become obstructed, and enlarged from the accumulation of fluid. A cyst-like tumor—dacryops—seen in the upper lid, is produced by the obstruction. The swelling can be seen more distinctly when the lid is everted; and it may then be punctured and allowed to discharge upon the conjunctival surface. If left to itself the fluid may find escape through the skin, and continue to discharge externally, constituting dacryops fistulosus. Should the minute fistula prove troublesome, it may be cured by perforating the lid with a modern punch for making eyelets, and then closing the external opening with fine sutures. The internal opening being left, the fluids from the duct will be turned inwards upon the conjunctiva, and thus a cure is effected.

The puncta lachrymalia are liable to be affected by conjunctivitis, the inflammation extending to the edges of the lids and to the mouths of the canaliculi; they are exposed to external violence; and they participate in diseases extending upwards from the lachrymal conduits. The puncta are frequently distorted or obstructed by cicatritial contractions. If the puncta become impervious the tears must escape by overflow. Under such circumstances the eyes appear suffused, and the cheeks are reddened by the trickling fluid.

When the puncta are free and the canaliculi are contracted or strictured, the eyes may exhibit a watery state, but as some of the lachrymal fluid escapes by these conduits, the overflow of tears is not so marked and troublesome as when the puncta are obliterated.

If the epiphora—lachrymal overflow—be exceedingly troublesome, and the puncta be incurably impervious, the lachrymal gland should be removed, to cut off the supply of tears.

In many cases of obstructed puncta and constricted canaliculi, the difficulty may be remedied by slitting open the faulty conduits. This is done by carrying a delicate probe or lachrymal grooved director along the whole course of the lower canaliculus, and following it with a slender knife which completely lays open the canal. Before introducing the probe or director the canaliculus is to be straightened by pull-

ing the lid outwards. After the incision has been made, a probe is to be passed along the track of the slit every day to prevent the lips of the wound from growing together.

If the overflow depends upon a faulty position of the punctum, the slitting of the canaliculus remedies the defect by the fact that the point of escape for the tears is carried nearer the caruncle where the outlet is the more readily reached, overflow being thus obviated. The canaliculus is converted into a gutter, which collects and bears along the tears. In cases of obstruction in the lachrymal sac or the nasal duct, the incision affords easy access to the seat of stricture.

It is no uncommon thing for the puncta to be turned in against the eyeball, where they are lost to view, and from their position can not gather the tears. In some cases the apertures are turned outwards, so they can no longer take up the tears. In either case a slitting up of the canaliculi will partially or wholly remove the difficulty. Operations for the cure of ectropion and entropion usually have in view, among other objects, a restoration of the puncta to their proper positions.

If the puncta be in their natural places, and the apertures appear open and unobstructed, yet the tears fail to pass off as fast as they are supplied, some obstruction of the canaliculi may be suspected. The pervious condition of these canals is to be tested by pressing the finger on the lachrymal sac just below the tendo-oculi, when, if the canaliculi be open, tears can be made to regurgitate. Of course, the action of the finger prevents the contents of the lachrymal sac from escaping downwards through the ductus ad nasum. If the manœuvre fail to discover the pervious condition of the canaliculi, a delicate probe must be made to explore the canals. As has already been suggested, the edge of the lid must be drawn outwards to straighten the tarsal border, hold it steady, and to take the abrupt angle out of the canaliculus. The probe should be manipulated carefully, as the lining of the canaliculus is extremely delicate. The butt of the probe may be weighty, but the part near the point should be slender and flexible. The point must not be too small, lest it catch in folds while being introduced. Several probes varying in size should be at command.

In passing a probe into the lower canaliculus, the instrument should be directed almost vertically downwards for

about half a line, and then turned inwards towards the nose, in which direction it will pass on, should no stricture exist, until its point strikes against the inner wall of the sac. Except to a practiced hand, it is often difficult to detect whether the point of the probe is arrested close to the junction of the canaliculus with the external wall of the sac, or whether the instrument has reached the internal wall. In the former case any considerable pressure with the probe produces a dragging effect upon the tarsus; whereas contact of the probe with the inner wall of the sac not only conveys to the hand a peculiar feeling of firm resistance, but at once causes all movement of the tarsus to cease. As the lachrymal bone is very thin and fragile, much pressure upon it will not be endured without danger of perforation.

If the canaliculi be found free from stricture, and the sac forms a distinct prominence below the inner canthus, it is pretty certain that the obstruction exists at the commencement of the nasal duct. To test this, the finger is to be pressed upon the swollen sac, when if the canal be closed, and the canaliculi be free, fluid will be made to escape from the puncta. But, if the canal be only narrowed, pressure downwards and a little backwards may overcome the stricture or obstruction and force the contents of the sac into the nose. Patients can be instructed in this manœuvre, so that they can empty a distended sac at will, and thus save themselves much inconvenience.

Undischarged tears in the lachrymal sac—and the presence of foreign particles, perhaps a stranded eyelash—tend to provoke inflammation in the lachrymo-nasal canal. In frequent instances of stricture of the ductus ad nasum, the irritation or inflammation may have begun in the lining of the nose, and extended to the lachrymal canal, but occasionally the difficulty commences in the sac. Arising from whatever cause, stricture of the nasal duct leads to trouble sooner or later. An inflammatory attack threatens a crisis. The sac becomes hard and painful, and a puffy condition of the lids follows. The redness appears erysipelatous, though it is not; and soon a condition of abscess affects the sac and surrounding parts. If the inflammatory process be left to itself, the pus finds an outlet through the skin, when the tension being removed, the inflammation subsides and the opening remains,

through which the tears escape upon the cheek, constituting *fistula lachrymalis.*

To prevent an incipient abscess of the sac from maturing it is well to slit open the canaliculus on a probe or director carried along the lachrymal conduit as already described.

FIG. 21.

Probing the ductus ad nasum: the canaliculus has been previously slit.

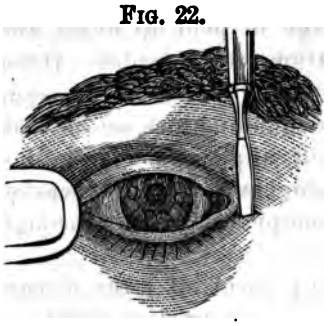
The incision laying open the sac allows a free discharge of pent up fluids, and the inflammation soon subsides. It has been recommended that efforts be made to reduce the inflammatory action with poultices, cold applications and anodynes, yet valuable time is often wasted in futile attempts at relief through medication.

Scarcely any form of local disease has given rise to a greater variety of local treatment than stricture of the nasal duct. If a fistula exist it may have contracted so that only a part of the lachrymal fluid finds escape, the remainder undulates in the lacus till the accumulation causes overflow. Although the symptoms of inflammation are not commonly prominent, the sac is tumefied, and when pressed upon with the finger will discharge muco-purulent matter through the puncta. The emptying of the sac in this way affords some relief, and patients resort to it very often.

Surgical ingenuity has not succeeded in establishing a ready and certain means of cure for obstructions of the ductus ad nasum. Slitting of the lower canaliculus and dilating the nasal duct with probes, bougies, etc., have commanded attention, yet the results are not always satisfactory. Dilatation of the stricture was at one time attempted, by the introduction of curved sounds into the nasal orifice of the duct. But these instrumeuts were difficult to introduce; they would not reach a stricture near the sac; and their manipulation endangered the fragile bones constituting the walls of the canal. Tubes of silver, gold, and platinum, were introduced into the sac and nasal canal, with the view of having them covered over by the healing processes; but the lachrymal fluids deposited concretions upon the metals, converting the instruments into foreign bodies not to be endured.

The *style* was in common use a few years ago. Its upper end was furnished with a nail-like head, to prevent the instrument from descending too low, and its neck was curved or made angular, to allow the head to rest evenly upon the skin. The style is introduced in two ways—one, by slitting the canaliculus as far as the sac, and then introducing it into the nasal duct, strictures having been overcome with a "needle-knife" or tenotome; the other, to first make an incision in the skin near the inner canthus and over the mouth of the ductus ad nasum, the knife transfixing the lachrymal sac and dividing the strictures of the nasal duct. Into the perforation made by the knife the style is made to go.

FIG. 22.



Puncture made to overcome stricture of nasal duct, and to make a place for the insertion of a style.

The mouth of the bony canal leading from the orbit to the nose is just within the inner extremity of the lower orbital rim. The finger pressed upon the spot indicated readily finds where the knife is to enter. Not much force must be used with the perforator lest the thin bones of the part be broken.

The style is to be taken out every day to be cleansed, then it is replaced. It is intended that the tears find their way along the sides of the style, and so empty into the nose. However, in most instances the style has not proved a success. Patients will often neglect to remove the instrument, leaving it in place till encrustations convert it into a source of irritation. Or, if the style has been carefully manipulated, and the obstruction seemingly overcome, the strictured condition returns again as soon as the instrument is laid aside.

Patients with stricture of the nasal duct are not always willing to persevere in the treatment until a satisfactory cure is accomplished. When probes are used as dilators they ought to be passed along the nasal canal every two or three days for a period of several months; and even then the use of bougies should be renewed if new troubles arise. The condition of obstruction is like indurated stricture of the urethra, and must be treated with the same general principles in view.

Obliteration of the sac has been advocated for the cure of lachrymal fistula, but the operation is less satisfactory than excision of the lachrymal gland. In the event of successful destruction of the sac, the tears find escape by overflow, creating an annoyance scarcely less than lachrymal fistula; but after removal of the gland there is no tear-waste to annoy, therefore the fistula will close without surgical interference. There is no uncomfortable dryness of the eye after the gland is excised. The conjunctiva furnishes some fluid and the Meibomian glands produce lubricating material for the tarsal borders.

Calculi have been known to form in the lachrymal sac, and to afford extreme annoyance. Their presence is to be discovered by carrying a probe through a canaliculus; and they are to be removed by slitting up a canaliculus and the sac, when the concretions may be easily turned out of place. Polypus of the sac—a rare form of disease—may be removed by a similar process.

Epiphora is constitutional in some families, especially in advanced life, the eyes constantly brimming with tears. The condition may result either from super-secretion of tears, or from incapacity on the part of the lachrymal conduits to carry away the fluids. Let the cause be what it may, the cure consists in removal of the lachrymal gland. Not much advantage could be expected from any kind of medication.

THE CONJUNCTIVA.

The membrane which lines the lids and covers the anterior portion of the eyeball, is called the conjunctiva. It is a mucous tissue, and is bathed with the lachrymal fluid. The outer layer of the cornea is the *transparent portion* of the conjunctiva; a crescentic fold or duplicature of conjunctiva at the inner canthus, called the *plica semilunaris*, rests on the tendo-oculi, and supports the caruncula lachrymalis; and the *limbus conjunctivalis*, so called, is the band of somewhat modified conjunctiva which extends upon the border of the cornea, especially above and below, and is especially perceptible in aged persons.

That part of the conjunctiva which lines the lids is called the palpebral portion. It begins at the free border of the eyelids, where, in a tarsal covering, there are eighteen or twenty small glands (Meibomian) which furnish a fluid to help lubricate the eye. After lining the lids the conjunctiva forms two folds, the superior and inferior, whose depths are called sulci; and then, as the scleral or ocular portion—the reflected conjunctiva—it covers the tendonous expansion of the muscles (Tenon's capsule), and being somewhat transparent exhibits the lustrous capsule as "the white of the eye." Still more anteriorly the ocular conjunctiva is attached rather loosely to the sclerotic; and its deep and superficial vessels here anastomose, forming a vascular zone around the cornea. Where the vascular ring is formed, the anastomosis extends to vessels which pierce the sclerotic and are continuous with those of the choroid and iris, hence the importance of noticing a prominent vascular zone in the diagnosis of diseases of the deeper structures of the eye. The corneal conjunctiva is devoid of vessels, except some vascular loops which may be traced into its border.

CONJUNCTIVITIS.—A large proportion of all "eye cases" which occur in practice will be found to embrace some form of conjunctival inflammation, though many of these morbid processes may originate in other tissues of the eyeball. Conjunctivitis proper should be restricted to those inflammatory manifestations which originate in the conjunctiva, or extend only to the sclerotic.

Conjunctivitis embraces the various forms of *ophthalmia* so elaborately described in systematic works on eye diseases. A light form of conjunctivitis is a *simple* ophthalmia; and severer forms of conjunctival inflammation may be *catarrhal*, *purulent*, *gonorrhœal*, *granular*, *scrofulous*, and *chronic*.

Simple conjunctivitis, or ophthalmia in its mildest form, is recognized by increased conjunctival vascularity, lachrymation, and an uneasy feeling in the eye. The uneasiness arises, in part at least, from the enlarged vessels, which, projecting above the membrane, produce a sensation as if foreign bodies (sand or dust) had lodged between the lids and the eyeball. And, in fact, irritating particles on the conjunctiva, may be the true cause of the inflammation.

Slight injuries, as the switch of a twig, whip, or wisp, are

often followed by conjunctivitis. The jagging of irregular eyelashes,or a single eyelash lodged in one of the puncta, may cause ophthalmic symptoms.

A cinder or bit of steel lodging in the substance of the cornea excites violent conjunctivitis; and an insignificant mote lodged behind the upper lid will create a disagreeable sensation in the eye, and a high degree of inflammation.

Riding in a cold wind, and the presence of irritating vapors and smoke, produce conjunctival congestion and mild ophthalmia.

Neuralgia and irritation of the ophthalmic ramifications of the fifth nerve, may be followed by conjunctivitis.

Treatment.—It is culpably meddlesome to prescribe lotions for every shade of conjunctivitis, for the cause may be temporary, and its removal will be rapidly followed by a subsidence of the inflammation. However, the cause should be sought in every instance, and if found to be the presence of a foreign body, it should be removed. The manner of discovering and removing foreign bodies lodged in the substance of the cornea, will be found under the head of *Keratitis*. The removal of ill-growing eyelashes is also spoken of under the same heading, as well as that of Blepharitis.

A mote lodged under the upper eyelid is to be sought by everting the lid. This requires considerable tact; and is accomplished as follows: a probe or pencil is laid horizontally across the lid, about a half inch from its free margin. The manipulator then grasps with his finger and thumb the eyelashes growing from the middle of the tarsus, and draws the lid away from the globe, while at the same time he slightly depresses the probe or pencil, and tells the patient to look downward. By this manœuvre the tarsal cartilage tilts over, and the conjunctival surface of the lid is exposed to view. The mote is almost invariably found near the middle of the lid not far from its tarsal margin. A patient, if instructed in the art, can often relieve himself by grasping the eyelashes of the upper lid with the thumb and finger of one hand and pulling the lid away from the eyeball, while a finger of the other hand pushes the lower lid upward and beneath the upper lid, and then letting the lids take care of themselves. The cilia of the lower lid serve as a brush to sweep the inner surface of the upper lid, and thus remove the foreign body.

If a simple conjunctivitis depend upon irregular habits, or intense action as in reading and the examination of minute objects, common sense suggests the remedy. Ill-conditioned patients need some general directions in regard to those means which promote vigorous health. Tonic and alterative medicine may be needed in some instances. Depletion with leeches, low diet, mercury, and other depressing agencies once so popular, is to be scrupulously avoided.

A collyrium which is mildly astringent may do some good. A decoction of table tea has been used with satisfaction, so has milk, and unmedicated liquids of a soothing character. A grain of sulphate of zinc or copper to an ounce of water, makes a harmless and often a useful wash. Some practitioners adhere to nitrate of silver and rose water, a grain of the salt to an ounce of fluid, yet this compound is no better than those mentioned. Another class of ophthalmic therapeutists laud a lotion made of an infusion of hydrastis or other vegetable tonic, and denounce all others.

A mild astringent wash, whether it be mineral or vegetable, is about all that is needed. An infusion of sassafras pith is mucilaginous, and is much used as a collyrium. Bathing the lids several times a day in warm or cold water, the temperature being modified to suit the feelings of the patient, is generally useful. Glycerine, sweet oil or any unirritating unguent applied to the edges of the lids at night prevents agglutination.

CATARRHAL CONJUNCTIVITIS.—A vascular and puffy condition of the conjunctiva, especially of the semi-lunar fold and caruncle, attended with inflammatory manifestations, is defined as catarrhal conjunctivitis. It may arise from exposure to draughts of cold air, or from various irritants affecting the eye. A burning, biting, and itching sensation accompanies an attack; and the secretion of considerable muco-purulent matter. The vascular congestion, as in simple ophthalmia, leads the patient to think that particles of sand or other minute foreign substances have lodged in the eye. In some instances the conjunctiva near the margin of the cornea swells, so that a state of *chemosis* exists.

A peculiar characteristic of catarrhal conjunctivitis is the existence of numerous red blotches as if there was a free anastomosis of a number of small vessels. These vascular

knots vary from the size of a pin's head to that of the caruncle. In some instances these blotches are true extravasations.

Although the lids become agglutinated at night, and the secretions are considerably increased, the patient complains of a sensation of dryness in the eyes.

Catarrhal conjunctivitis in its severer forms is attended with impairment of vision. Turbid mucus suspended in the tears and diffused over the cornea, may cause part of the visual defect.

Eczematous and exanthematous eruptions are frequently accompanied or followed by catarrhal conjunctivitis, therefore, writers upon the subject have designated the different forms of ophthalmia dependent upon an eruption by the specific exanthem producing the conjunctivitis.

It is probable that some degree of transmissibility from one person to another, by contact of the secretion through the medium of a towel, exists in certain forms of ophthalmia, including the catarrhal. It is claimed that a certain variety of ophthalmia in one person, begets a different variety when communicated to another individual.

Treatment.—The remedies recommended for simple ophthalmia are often serviceable in the catarrhal form of the disease. The cause should be removed if possible, and everything made favorable for recovery.

Collyria are generally used, though they often aggravate the difficulty. I have seen a wash made by adding a grain of the nitrate of silver to an ounce of water, effect so speedy a cure, when applied to the conjunctiva twice a day, that I was captivated with its action. However, the lotion is not always a remedy, and often an aggravating agent. So it is with solutions of zinc, copper, lead, alum, *et id omne genus.* And, what is puzzling, there are no reliable indications for lotions of an astringent character. A quick sweep across the conjunctiva of a sulphate of copper pencil once in three or four days, and the use of a solution of tannic acid—two grains to the ounce of water—several times a day, the wash coming between the applications of sulphate of copper, will often work well.

When vascular blotches exist I have touched them once in two or three days with a pencil of wood, the smooth point of

which had been dipped in nitric acid. The rounded point of a common match will do for the pencil; and after being dipped in the acid it should not appear wet, but the acid should have struck into the wood. This is an effective way to make a circumscribed impression upon fungous elevations and vascular excrescences. In what is called *pustular ophthalmia* there is no better way to destroy the pustules or papules than to touch them with the nitric acid pencil.

I have lately met with excellent results in the management of catarrhal and purulent ophthalmia by using as a lotion a dilute form of the fluid extract of *Pinus canadensis*. I commonly put eight or ten drops of the extract into an ounce of water, and order it used three or four times a day.

In the treatment of catarrhal ophthalmia, the general health of the patient is not to be neglected. A constipated state of the bowels is to be overcome with broken doses of sulphur, or such laxatives as are ordinarily favorites. An anæmic patient needs iron and stomachics; the sufferer from miasm should have quinia; and the exhausted individual demands rest and restoratives.

Inflamed eyes generally should be used as little as possible, and be shielded from strong light, and irritating vapors.

Conjunctivitis complicated with sclerotitis, iritis and choroiditis, as it often is, should be managed with due regard to the complications. If the vascular scleral zone be apparent, astringent washes are contra-indicated, and a solution of the sulphate of atropine should be dropped into the eye; and the organ should be kept shaded. Neutral tint glasses may be worn by those who take exercise in the open air.

PURULENT CONJUNCTIVITIS.—A purulent disease of the eyes, historically known as Egyptian Ophthalmia, from the fact that armies invading Egypt have suffered from the scourge, begins as a violent conjunctivitis, and often terminates in the destruction of vision in one or both eyes from disorganization of the cornea and iris. The affection is most common in hot and miasmatic countries, yet it is not unknown in high latitudes. Certain locations in the Mississippi Valley are subject to annual visitations of the disease; and many of our State institutions for the blind contain scores of victims who have lost their sight from the effects of this terrible disease.

The British hospitals of Chelsea and Kilmainham, according to Dr. Macgregor, contained at one time *two thousand three hundred and seventeen soldiers* who were totally blind from purulent ophthalmia. A faithful chronicler says; "Fifteen days after the 'Rodeur,' a slaveship, left the coast of Africa, purulent conjunctivitis broke out among the slaves; and at the end of the voyage, thirty-nine were totally blind, twelve lost each an eye, and fourteen had corneal opacities. Of the officers and crew, twenty-five in number, all were attacked; twelve persons, including the surgeon, lost their vision, five of the remainder lost one eye, four escaped with opacity of the cornea and adhesion of the iris, and the remnant ultimately recovered."

The symptoms of the several forms of purulent ophthalmia resemble each other so closely in some stages of the disease, that a common purulent conjunctivitis can not be distinguished from one of gonorrhœal origin; and the pus from the eye of an infant suffering from what is called *ophthalmia neonatorum*, if applied to the eye of a healthy individual, young or old, may set up all the phenomena of purulent conjunctivitis. In fact, all forms of the disease are presumed to be contagious; and the symptoms closely resemble each other in the several varieties of purulent ophthalmia.

Simple conjunctivitis is not so violent as the purulent type. In the contagious and vicious form of the disease the eyelids hurriedly become congested, then swollen, and soon after a profuse discharge escapes from the mucous surfaces. From the first there is increased lachrymation; a few hours later the fluid poured forth is muco-purulent, and in a day or so from the onset of the attack a greenish pus is abundantly discharged. The local disorder, attended with pain and photophobia, is quickly followed by general fever.

The patient soon becomes pale and depressed; and the lids, seemingly œdematous, take on a dull red appearance, inclining to purple. The dried secretion binds the tarsal borders of the lids together, and thus dams back the forming fluids, so that the palpebral sinuses become distended, imparting to the lids a still more swollen appearance. If the agglutinated lids be pulled apart, the pent-up secretion pours forth as from a recently incised abscess.

When the lids are forced from one another the cornea is

seen bathed in pus, and surrounded and overlapped by a wall of puffy conjunctiva. This condition is often destructive to the cornea. The puffed up and overlapping wall of conjunctiva, called *chemosis*, is thought to interfere with the circulation at the margin of the cornea. Beneath the edge of the overlapping conjunctiva an ulcer may form or softening set in, either of which endangers perforation of the aqueous chamber.

A mild case stops short of ulceration, the inflammation subsiding before irreparable harm is done; but in severer cases a *slough* of the cornea takes place, or an ulcerative action which may result in thinning of the cornea and a consequent *staphyloma*. An ulcerative process beginning at the corneal margin, usually extends so as to excavate a crescentic groove; and if any part of the corneal structure be perforated, a portion of iris prolapses, producing the appearance of a black speck or a dark colored nodule at the bottom of the ulcer. Protrusion of the iris causes distortion of the pupil; and the disorganization is attended with impaired vision, if not a total loss of sight in the affected eye.

In a case of acute purulent conjunctivitis the swelling obscures the Meibomian glands; and may so evert the puncta that they fail to conduct the tears into their natural channels, consequently a stream of the lachrymal fluid constantly overflows at the inner angle of the eye, giving the patient considerable inconvenience and discomfort.

Treatment.—If promptly called to a case of purulent ophthalmia, the practitioner should consider the general condition of the patient. If a full habit and a robust constitution admit of evacuations, a brisk cathartic may be given with marked advantage. A free movement of the bowels is attended with diminished determination of blood to the head. This is not depletion, but an unloading which is desirable at the commencement of many forms of acute disease.

After the bowels have been moved, anodynes, which are often useful to secure rest, exert a more favorable influence. Large doses of gelseminum, or chloral, relieve the patient of irritability, and thus, indirectly at least, contribute to a cure. Although poultices are often agreeable applications to inflamed eyes, they are thought to favor sloughing of the cornea, therefore, should be prohibited. Cold compresses, often renewed,

are very agreeable applications. It does little good to medicate the fluids which wet the compresses, unless a mydriatic be required.

Patients affected with miasm should have quinine and mineral acids; and the ill-fed and exhausted should be supplied with easily digested and nourishing food. Alcoholic stimulants are generally injurious, though a patient accustomed to such beverages might suffer from their sudden withdrawal.

The local treatment of purulent ophthalmia is the most important part of the medication; and is to be modified somewhat by the condition of the cornea, and the stage of the disease. The photophobia is often so great that the patient will not allow the cornea to be exposed to light. The lids are slippery with secretions, therefore it is not easy to hold them apart, especially if the patient be a child. Rough handling might burst a softened or ulcerated cornea. Frequently it is best to subdue irritable patients with chloroform; and while the anæsthesia lasts the lids can be opened, the cornea examined, and the medicine thoroughly applied without inflicting pain.

Those who expect to subdue an acute conjunctivitis with mild astringent washes, are sure to be disappointed. The ordinary solutions of mineral salts do very little good, and often harm. If such remedies be used the active caustic is the best. Nitric acid at full strength, applied with a spatula of wood to the highly inflamed and chemosed conjunctiva, makes a favorable and lasting impression. It may be applied every second or third day. I have lately had the best effects from the unreduced aqueous fluid extract of Pinus canadensis. A pencil or spatula of wood, wrapped with patent lint or soft muslin, is dipped in the extract and then applied to the palpebral sinuses. Each lid is slightly raised from the globe, and then the implement can be introduced into the sulcus and be made to sweep over the inflamed surfaces. Some of the extract comes in contact with the cornea, but that does no harm. A moderate degree of smarting is excited by the application, yet the distress thus produced is not lasting. An application once a day, or every second day, will generally prove so far curative in a week, that a dilute wash of the same agent is only needed to complete the cure. I have been

surprised to observe the superiority of this application over the old collyria made of zinc, copper, nitrate of silver, lead, alum, tannin, and other well known agents. The discoloration caused by the escape of the extract upon the cheeks, is readily removed. The remedy arrests the profuse purulent secretion, subdues the congestion and chemosis, and generally preserves the integrity of the cornea.

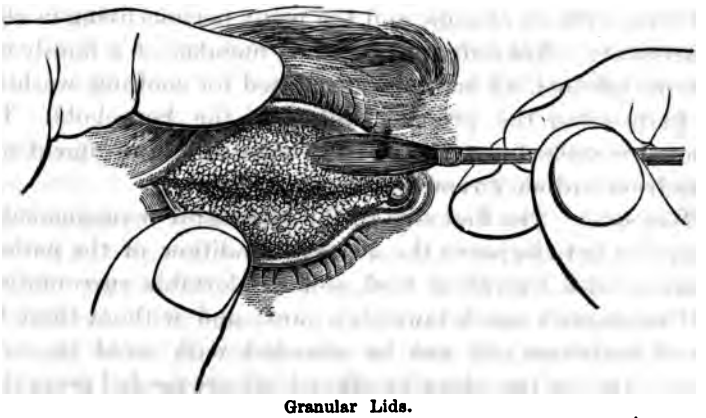
As yet there are no officinal forms for fluid extracts of Pinus canadensis. The alcoholic extract causes slight smarting, when applied to sensitive surfaces, therefore an aqueous fluid extract will do better, especially when it can be prevented from fermenting. It is not so thick and turbid as Kennedy's preparation, yet more efficient and less objectionable. When ulcers of the cornea, staphyloma, or prolapse of the iris have occurred in the advanced stages of the disease, and the conjunctivitis has principally subsided, the complications must be managed according to rules laid down under treatment of the cornea and iris. It is always desirable to save as much of the cornea as possible; and if an artificial pupil promise to improve vision, it is to be made at the proper time. I may mention in this place that eminent oculists recommend incising a chemotic conjunctiva to relieve the congestion and the pressure upon the margin of the cornea. I have done this myself, but am not convinced that it did any good.

In cases of suspected intraocular pressure the cornea may be punctured every day with a cataract needle to let out a few drops of the aqueous humor. I have known considerable relief to follow the paracentesis; and no subsequent defect of the cornea at the point of puncture. The difficulty is in certainly knowing when paracentesis is necessary. Painting the lids with a strong solution of nitrate of silver—caustic in strength—is highly commended as a means of arresting violent conjunctivitis. While I do not condemn the measure as always useless, I believe it may occasionally do some harm. If the action on the integument be followed by cicatrization the lid would be distorted. Caustic applications to the conjunctiva have been followed by cicatrizations which warped the tarsal cartilages.

GRANULAR CONJUNCTIVITIS — TRACHOMA. — A common sequence of conjunctivitis, especially the purulent variety, is the formation of vascular or papillary excrescences, called "granu-

lations," on the conjunctiva. A hazy and vascular state of the cornea follows sooner or later. During the progress of purulent ophthalmia, the palpebral conjunctiva becomes spongy or villous; and, after the purulent discharge has subsided, this condition of the membrane does not lessen, but goes on increasing, until its surface resembles that of a granulating ulcer. In fact, there seems to be a disposition in the reparative action to overcome the conjunctival defect by blending its palpebral and ocular surfaces—by establishing ankyloblepharon. In the earlier stages the "granulations" may be simple enlargements of the follicles and papillæ of the conjunctiva. "*They are sometimes of the same color as the conjunctiva, and only slightly prominent, but again are greatly elevated from its surface, and from their shape and gelatinous translucency resemble the spawn of fish or frogs.*" (Stellwag). The firmness and solidity of the granulations vary in different subjects and in varying phases of the disease. When hard, and of considerable size, they cause irritability and provoke blinking of the lids.

FIG. 23.



Granular Lids.

In some cases the trachomatous bodies are confined to the tarsal border of the conjunctiva; and the rest of the membrane exhibits only an evanescent vascular injection. Occasionally the palpebral sinus, on eversion of the lid, seems filled with a mass of granulations which protrude into a ridge, and encroach upon the cornea. The swelling and the granular mass in such cases appear somewhat like ordinary chemosis. The semilunar fold and the caruncle may become

involved in the morbid action, and take on a granular appearance.

In the earlier stages of *ophthalmia granulosa*, the lachrymal secretion is increased, and at length a turbid mucus comes in abundance, which mixes with the tears. During the stage of decline too little fluid is furnished to lubricate the roughened conjunctiva, and a sensation of dryness under the lids is experienced.

In severe cases of long standing the levator palpebræ muscle loses its tone and the upper lid drops or hangs down, and becomes sufficiently everted to expose some of its conjunctival granulations.

Patients suffering from granular conjunctivitis are troubled with cloudy vision and irritable eyes. They can not endure smoke, dust, cold winds, and bright light. The impaired vision depends chiefly upon corneal complications, especially vascular keratitis.

Granular conjunctivitis, like the purulent form of ophthalmia, is unquestionably contagious; and is aggravated by miasm, squalor, poor food, lack of cleanliness, garments worn too long without change, and too many persons living in close apartments. Not unfrequently every member of a family will become affected, all being incapacitated for cooking, washing, or performing the pressing duties of the household. The general wretchedness cuts off the hope of improvement or a cure from ordinary remedial measures.

Treatment. The first step in the successful management of trachoma is to improve the general condition of the patient. Clean clothes, nutritious food, and comfortable surroundings will accomplish much towards a cure; and without these the use of medicines will not be attended with rapid improvement. One or two clean handkerchiefs are needed every day, and a fresh towel.

An every-other-day attack of fever is to be overcome with antiperiodics; constipated bowels are to be moved with sulphur; an atonic stomach is to be persuaded to action with mineral acids and bitter tonics. It is unfortunate that patients, when they get a little better, neglect or abandon the means of cure. Many persons afflicted with trachoma, may get nearly well under judicious treatment, and then foolishly grow remiss, or refuse to do anything more. The consequence is

that a "relapse," as they call it, supervenes; they then change physicians, or openly declare that all medication is useless.

The local treatment for trachoma, as practiced among the distinguished oculists of the day, is not varied. The sulphate of copper in a pencil or pointed crystal is in extensive use to touch granular lids; and many agents in reputable use are not so good. I have seen notable cures brought about by the every-day use of this agent. The nitrate of silver, in solutions of varied strength, is a common remedy for topical application. It is generally applied to the everted lids with a camel's-hair pencil. At first, or occasionally, a strong solution—from ten to thirty grains to an ounce of water—is employed. This is designed to produce a caustic effect; and may be repeated every day for several days in succession. A weaker solution, from one to five grains to an ounce of fluid, is that in common use. When a solution of caustic strength is applied, the parts cauterized should be immediately brushed over with an alkaline solution to protect the cornea and to prevent the caustic effect being too lasting.

Caustic applications, unless used with caution, will produce a permanent curving of the tarsus and a consequent ectropion. The ordinary astringent lotions of alum, tannin, and kindred agents, are powerless to subdue the severer cases, therefore the treatment must be conducted with much discretion. Even when a granular state of the lids has been overcome, vision may remain impaired in consequence of an opaque cornea kept up by the passage of large blood vessels which enter its borders and sometimes traverse its entire diameters.

The plan of treatment in favor with me is about as follows: I cauterize the granular surfaces with nitric acid chemically pure and at full strength. To restrain the agent to surfaces intended to be cauterized, a spatula of soft wood is used. This is dipped in the acid, and then held in the air a few minutes to allow the caustic to sink into the wood. The spatula is not to be used until all wetness on the end of the stick dipped in the acid has disappeared. The upper lid is to be everted in the usual way, and the spatula laid upon the granular excrescences. The acid in the wood turns the granulations white, and imparts a keen burning sensation for a minute or two, then the painful impression passes off. The lower lid is to be turned down and treated in the same way,

there being enough caustic power left in the wood to whiten the granulations there. If the lids of the other eye need cauterizing, they are to be treated like the first.

The cauterization may be repeated on the third or fourth day; and on the intervening days the fluid extract of Pinus canadensis is to be applied to the granular surfaces. This agent may be employed with a delicate swab, which is made by running a strip of soft muslin on a pencil of wood. The extract exerts an active influence, causing the granulations to disappear much faster than when treated to caustics alone.

The vessels entering the cornea are to be obliterated after the conjunctival granulations have been subdued. This part of the treatment is to be accomplished by applying nitric acid to the edge of the cornea just over the largest vessels; and performed with great care so as not to injure other portions of the cornea. A splinter of wood whittled to the size and shape of a common probe, is dipped in the acid, and, when free from wetness, is pressed gently upon the vessel or the margin of cornea covering it. This is repeated every four or five days. If any cicatrix follow the cauterization, it is out of the range of the visual rays. As soon as the vessels are obliterated, the haziness of the cornea begins to disappear.

Nervous and refractory patients may be subdued with chloroform before the caustic is applied. Generally no anæsthetic is needed. After the granulations are overcome, and the corneal vessels obliterated, the following collyrium may be used:

℞ Water, f℥iv.
Fld. ext. Pinus canadensis, gtts. xx. M.

S. Use between the lids several times a day.

During the severer forms of the disease and treatment, the patient may take an anodyne at night to induce sleep; and cloths dipped in cold water may be applied to the eyes.

Some cases that have been injudiciously treated with caustics and astringents, may exhibit a cicatrose state of parts of the conjunctiva, and a curvature of the tarsal cartilages. Such complications are unfortunate, as they can not be remedied without operations upon the lids; and even then the results are not always satisfactory.

I have occasionally met obstinate cases of vascular opacity of the cornea, none of the vessels being large, but countless

in number. Such cases require a cauterization of almost a complete ring at the border of the cornea before the morbid vascular state will yield. During the treatment of granular ophthalmia, the iris and choroid may exhibit inflammatory action. However, little additional can be done except to screen the eyes from strong light, and apply Belladonna to the integument of the lids. Such inflammation generally subsides as the curative action in other parts progresses.

GONORRHŒAL CONJUNCTIVITIS.—It would be difficult in all cases to differentiate between a severe attack of purulent ophthalmia and gonorrhœal conjunctivitis. It has been asserted that gonorrhœal ophthalmia confines its attack to one eye; but such is not the case. It is plain that both eyes may be infected by the same towel or from the same source, whether it be a contaminated finger or wiping cloth. I recently saw a well-to-do farmer sixty years of age whose corneæ had perished and the irides were laid bare by gonorrœhal ophthalmia which attacked the eyes simultaneously. He was just recovering from gonorrhœa contracted a few weeks previously. He thought the virus was transferred frem the penis to the eyes by rubbing the lids with the fingers after he had dressed the penis with a stall. Not many months ago I was called to a patient laboring under gonorrhœal conjunctivitis in both eyes. His physician had applied a poultice to the inflamed parts the evening before, and when the application was removed in the morning the two corneæ were resting on the surface of the cataplasm. The patient declared that the poultice made his eyes comfortable soon after it was applied; but undoubtedly the comfort came from the diminution of intraocular pressure after the corneæ sloughed. The poultice favored softening of the corneæ.

Gonorrhœal, like ordinary purulent ophthalmia, begins with redness of the conjunctiva, and a sensation of sand beneath the lids. In a few hours a muco-purulent discharge sets in, and the ocular conjunctiva becomes puffy from infiltration of serum. The swollen membrane overlaps the cornea at its margin, constituting *chemosis*, which is a marked symptom of gonorrhœal contamination. The lids get red and swollen, and separate with difficulty. At this stage the cornea is to be carefully inspected if possible. The lids are so stiff, and the patient often so irritable that anæsthesia is necessary to

obtain a view of the cornea. A wire speculum is a useful instrument to hold the lids apart after the patient is subdued with chloroform. A small spatula is needed to turn back the overlapping conjunctiva, and a swab of lint can be employed to wipe the border of the cornea, where the dreaded ulcer is most likely to be found.

Treatment.—This does not differ essentially from that advised for ordinary purulent ophthalmia. If the patient be anæsthetized to have the cornea exposed, that is the time to apply the caustic if one be used. A spatula of wood dipped in nitric acid, as described in another place, may be applied to the inflamed conjunctiva, and especially to chemosed parts. This makes a decided impression upon the puffy and spongy surfaces, which is highly beneficial. Cold compresses often renewed, are to be kept upon the lids ; and the next day the fluid extract of Pinus canadensis is to be applied beneath the lids, with a mop made by wrapping soft lint upon a spatula or pencil of wood. This agent tends to arrest the secretion of pus, and to preserve intact the imperiled cornea. After the extract has been applied to the inflamed conjunctiva, the cold, wet cloths are to be kept in contact with the lids. The application of the extract should be repeated every day, until the violence of the symptoms is subdued. Afterwards, a very dilute form of the extract—four or five drops to the ounce of water—is to be used as a wash.

If the cornea ulcerates or sloughs, as it may in some instances, the staphyloma, prolapse of the iris, and other complications are to be managed as directed in articles on those subjects. No special rules need be repeated here.

The general condition of a patient affected with gonorrhœal ophthalmia, is to be managed with a view to sustain the vital powers. Depletion, as once practiced in many forms, is now strictly prohibited by the latest and best authorities. If any writer still adheres to leeches, antimony, *et id omne genus*, he will find few to follow his antiquated and ruinous notions.

PURULENT CONJUNCTIVITIS OF INFANTS.—(*Ophthalmia Neonatorum.*)—It is not uncommon to meet with a mucous discharge from the eyes of infants. This may be simply a catarrhal condition which will pass off in a few days whether any treat-

ment be employed or not, yet while the discharge is present, it creates apprehension of a more serious difficulty.

Physicians and experienced nurses are aware that infants a few days old are sometimes attacked with a purulent conjunctivitis which often proves destructive to sight. The disease is all the more to be dreaded because the patients are so small and difficult to treat.

The most prominent symptoms of the disease are swelling of the lids, purulent discharges from the closed palpebral fissure, irritability of the eye-structures, and fever about the head. If the lids can be opened, the conjunctiva will be found excessively red, puffy, and in a chemotic state about the cornea.

The disease has been supposed to arise from contamination at the time of birth, the external genitalia of the mother being the seat of gonorrhœal or infectious discharges. Such, of course, may be the cause of *ophthalmia neonatorum*, but not a very frequent origin of the disease. It is well known that cases occur when the maternal contact was free from contagious qualities, and the early attentions to the infant were conducted with the most scrupulous regard to cleanliness and the avoidance of noxious influences.

The danger attending an attack of purulent ophthalmia in infants, threatens the integrity of the cornea. Ulceration may be followed by staphyloma; ulcers are succeeded by perforation of the cornea, and prolapse of the iris; and the entire cornea may be lost in a slough. If any part of the cornea can be saved, it will serve a valuable purpose, though perfect vision be out of the question.

Treatment.—There being no essential difference between *ophthalmia neonatorum* and the purulent conjunctivitis of adults there need not be much variation in the treatment, except that which is due to the delicate infantile organism. The child is to be well nourished, and kept in a cleanly condition. The eyes are to be made cool by wetting them often with cold water; and strong light should not be admitted to them. Astringent lotions do little if any good, especially should the disease be of a violent character, as it often is. But, as the destructive tendency of the disease is well known, active measures are to be instituted at once. The delay of a day may be fatal to vision. The fluid extract of

Pinus canadensis, reduced one-half with water, is to be carried under the lids with a delicate swab. The lids are held closed with such firmness, that a camel's-hair brush can not be employed with effect. The stick used in the construction of the swab should come from wood not easily broken. The swabbing should be repeated every day, until the violence of the disease is spent. Then an every-other-day application will do, till, at length, no treatment is needed.

The daily inspection of the cornea, insisted upon by some ophthalmologists, is unnecessary, and frequently harmful. What could the wise inspector do if he did see an ulcer? Would looking at it arrest its progress? If it be urgent that the corneæ be inspected occasionally, let the little sufferers be put under an anæsthetic, and then the inspection can be conducted with deliberation.

As a topical application to the integument of the lids and regions about the eyes, I would recommend equal parts of the tinctures of aconite and belladonna, and this mixture reduced ten times with water. This wash relieves pain, keeps the pupils moderately dilated, and exercises a restraining influence upon the local fever.

Complications arising from infantile ophthalmia are in due time to be managed according to rules laid down in the treatment of purulent conjunctivitis in general.

SCROFULOUS AND STRUMOUS CONJUNCTIVITIS.—Several varieties of conjunctivitis exist which, from peculiarities, can not properly be arranged under the forms of ophthalmia already described. There may be some propriety in subdividing the scrofulous or strumous variety of conjunctivitis into a half dozen forms, but all would have phases in common.

In what has been termed the phlyctenular form of conjunctivitis the cornea is the centre of action. A minute blister appears first, and this degenerates into an ulcer, which is attended with pain and excessive lachrymation. A vascular track extends from the ulcer to an inner or outer canthus, the vessels furrowing the layers of the cornea. Intolerance of light induces a spasmodic action of the orbicularis palpebrarum muscle, so that the lids remain nearly closed, and are parted with difficulty.

The local disorder produces general nervous irritability; and a train of constitutional symptoms arise which seem out

of proportion to an ordinary ocular defect. In fact, the disease is systemic in its nature, and the local disorder is only a phase of it.

In some instances the disease is pustular in character, the pustules forming mostly upon the conjunctiva. In this form of ophthalmia the intolerance of light is not so great, and the constitutional shock or impression not so marked. Patients with vesicles, and even pustules, upon the conjunctiva may continue at ordinary vocations, and experience very little inconvenience, especially if the corneæ remain in tact. The eyes feel as if particles of sand, or minute foreign bodies had lodged under the lids. Not uncommonly the pustules burst and discharge, and the little ulcers heal without any kind of treatment.

Eruptive diseases, as scarlatina, measles, and variola, are sometimes attended or followed by exanthematous affections of the conjunctiva. Not unfrequently the ocular disturbance is so great that strong light can not be endured, and a real conjunctivitis is developed. However, as soon as the primary disease subsides, the photophobia and excessive conjunctival vascularity pass off. The general debility produced by measles is occasionally followed by conjunctivitis and ulceration of the cornea; and scarlatina, from the severity of the disease, is still more liable to conjunctival complications of a serious nature.

Erysipelas about the face may extend to the conjunctiva and exert a destructive influence upon the mucous structures, not exempting the lachrymal apparatus. Variola is especially damaging to the eye-structures, the corneæ, from opacities and cicatrices, suffering most, though the borders of the lids and the conjunctival linings may be involved in the deformities.

Eczema, or herpetic affections of the tarsal margins of the lids, may impress morbidly the conjunctiva, and establish a form of ophthalmia difficult to cure. Eczematous lids are about sure to be attended with conjunctivitis. Chronic states of any of the varieties of ophthalmia just mentioned, generally exhibit the characteristic pinkish zone in the sclerotic near the cornea. The inner angles of the eyes show prolonged irritation, which is due to a constant flow of tears, and to repeated wipings and rubbings of the parts.

A scrofulous or strumous conjunctivitis may appear during childhood or adolescence, and then disappear from the renovating character of changes which take place at puberty. In connection with the eye-difficulty there may be scrofulous manifestations in other parts of the body. And these, too, may disappear at puberty, or soon after.

Treatment.—From what has already been said in regard to the nature of the different forms of conjunctivitis just enumerated, it will be seen that constitutional treatment must embrace an important part of the therapeutical management of the disease. What generally pass as "alterative" medicines should be exhibited, if not continuously for weeks, at least in broken periods for months. It is often no loss to allow a few days to intervene, during which no medicine is given. Sulphur is a valuable alterative, and may be given alone or in combination with sulphate of magnesia and cubebs. I generally employ the agent in combination with the laxative and stomachic just mentioned. Iodoform, in grain doses, and pill form, covered with sugar, is an excellent alterative, but does not often agree with the stomach. The iodides can be disguised in several vehicles, and be taken for a long while without deranging the stomach. Cod liver oil exerts alterative powers, but is disgusting to most patients. Arsenic is an efficient alterative and tonic; one or two drops of Fowler's solution may be given every three or four hours without producing the slightest poisonous effect. In strictly therapeutic doses, which are always small, arsenic is not a poison; and in scrofulous and tuberculous diseases it is invaluable.

The syrups of sarsaparilla and stillingia, compounded in the usual manner, are convenient vehicles in which to exhibit some of the iodides; but they often offend the stomach, and thus do more harm than good.

A patient with strumous conjunctivitis needs a nourishing diet; and digestion, as well as assimilation, should be promoted with such medicines as are known to assist the nutritive processes. There is a great difference in the characteristics of individuals; one will improve under a certain course of medication and alimentation, and another would fail to be favorably impressed with the same regimen. To lay down rules dogmatically for all classes and conditions of mankind

would be ridiculous. The physician must exercise a just discrimination in every case, and avoid a routine course. "To sustain the vital powers" does not necessarily mean that tonics must be administered exclusively. If iron be employed the doses should be small. There is a popular belief that feeble persons have too little iron in the blood, which is sometimes correct, but the weak do not improve so fast under large doses of ferruginous preparations as they do when little is given. It is not often safe to follow the caprices of the unprofessional in the matter of medication.

The topical treatment of strumous ophthalmia is to be varied according to local morbid conditions. An ulcer upon the cornea is to be managed according to rules laid down in another place under the head of *Keratitis*. Lead-lotions should not be used lest an insoluble deposit be left in the cicatrix. It is generally best to cauterize the borders of the ulcer every few days with nitric acid, using a pencil of wood as the bearer of the caustic, and to treat the inflamed conjunctiva with mildly astringent collyria during the intervals. Vascular granules are to be treated as ordinary trachoma. Herpes upon the tarsal borders of the lids, with stiff and irregularly set cilia, may be subdued with a cerate employed to overcome tetter.

The following prescription calls for an agreeable pomade:

℞ Ung. aquæ rosæ, ʒj.
Fowler's solution, fʒj. M.

S. Use twice a day upon the edges of the lids.

A purulent discharge may be arrested by the use of a wash made from the extract of Pinus canadensis. As the purulency subsides the collyrium may be weakened.

Opacities of the cornea following ulceration, will generally become less and less dense, especially in the young. A prominent cicatrix moderate in size is carried to one side of the axis of vision by an accommodating squint, which is a useful strabismus, and not to receive treatment.

Conjunctivitis arising from exanthematous affections generally passes off in a few days or weeks, no treatment being demanded. Variola is the most likely to be followed by ulcers of the cornea and troublesome cicatrices. Erysipelas frequently leaves vascular excrescences on the conjunctiva,

which obstinately resist means used to overcome them. Measles produce active conjunctivitis for a few days preceding and attending the exanthem, and this may degenerate into a chronic form which may prove quite intractable. Scarlatina has been accompanied with ophthalmia so violent in its nature that the corneæ have sloughed in spite of well-directed efforts to save them.

Chronic Conjunctivitis, as such, without being introduced by acute symptoms, is occasionally met. It begins in a hyperæmic condition of the edges of the lids, and a redness and fullness of the caruncle and semilunar fold. The lids feel stiff, and as if gritty particles were producing the trouble; luminous bodies, surrounded by a halo of prismatic colors, prove annoyances; the eyes water when exposed to bright light or cold winds, and the eyelashes and angles of the lids become loaded with muco-purulent matter, especially during sleep.

Ophthalmia of a chronic character, as that just described, needs constitutional and local treatment; and it often resists the most judicious measures directed for its cure. At least, it exhibits a disposition to return after being thoroughly routed. Persons affected with humors of the tetter family, may have the eyes recover as soon as an attack of asthma sets in, or pruritus of the perineal region comes on. A patient of mine suffered for years with chronic ophthalmia, and then, while no treatment was employed, all at once the eyes recovered, and a persistent, irremediable pain became located near the lower end of the right lung, accompanied by cough. After this had continued for a year or two, salt rheum appeared on the hands, and the thoracic trouble subsided. At present the conjunctivitis has returned, and the other affections have disappeared. It is not easy to explain this seeming metastasis, yet changes in the form and location of morbid action are not very uncommon.

PTERYGIUM.—A vascular and fibrous growth, beginning at the semilunar fold, in a broad base, and extending towards the cornea, and even upon that body, the apex and general mass of the neoplastic structure resembling the head and tail of a comet, is called *pterygium*, from the corneal part appearing so much like the delicate outlines of an insect's wing. The growth outside the cornea is a reddish, fleshy-looking

substance, having a conjunctival development, and is loosely connected with the sclerotic body. It is raised above the ordinary level of the conjunctiva; and to the finger feels like a muscular mass. The disease, in some form, is rather common, though the severer types which demand treatment are somewhat rare.

Moderately developed vascular masses along the course of the inner recti muscles, the corneæ not being invaded, are denominated false pterygia, and are objectionable only as deformities, the vision not being affected.

A very large pterygium may extend clear across the cornea, and very seriously interfere with the transmission of light. In most cases which demand treatment the apex of the growth reaches to the centre of the cornea. Persons in middle life are most subject to the disease; and especially are they affected who expose their eyes to the irritating influences of dust and acid gases. Individuals suffering from "weak eyes" may at length have to endure the inconvenience of pterygium.

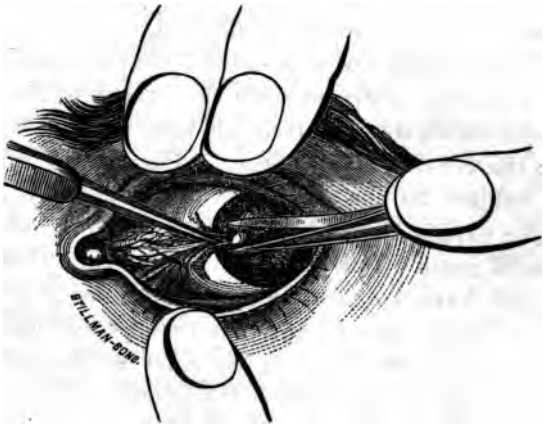
The conjunctival hypertrophy, for such pterygium seems to be, is not absolutely confined to the inner canthus of the eye. Cases are occasionally met where the growth springs from the outer canthus, and from above and below. One eye alone may be affected, though from sympathy or identity of influence both eyes become at length implicated.

Treatment.—Excision of a portion of the vascular growth near the cornea is an effective method of destroying pterygium, so also is ligation of the neoplastic mass at the point where excision is advised. In several instances I have obliterated pterygium by attacking it with nitric acid. The end of a pencil of wood is dipped in the acid, then, when seemingly dry, it is applied to the vascular growth near the cornea, the cauterization extending clear across the the morbid mass. This agent, applied a few times at intervals of three or four days, constringes the vessels, and even obliterates them. Absorption then carries away the part which is upon the cornea, and the part between the cicatrized line and the inner canthus gradually disappears.

Excision may be performed as follows, according to Arlt: "While an assistant holds open the lids, the operator seizes the pterygium near the scleral border with a pair of reliable forceps, draws it away from the globe, and separates the cor-

neal portion from the apex with a pair of scissors curved on the flat, or, what is to be preferred, enters a pointed bistoury or cataract-knife flat on the sclera, and cuts with a gentle course of the knife the corneal portion extending above the level of the sclerotica as evenly as possible from its substratum. Then the separated portion of the pterygium is drawn up, and the conjunctiva dissected up with the scissors toward

FIG. 24.



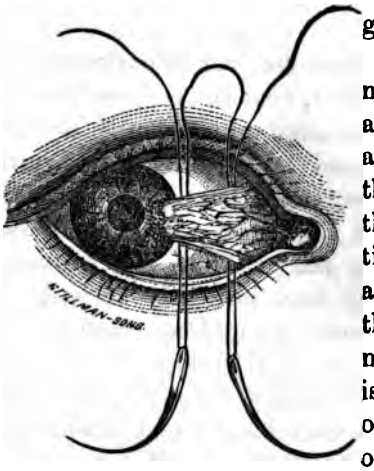
Method of removing a section of a pterygium with scissors.

the palpebral fold, one or two lines distant from the corneal margin, keeping exactly to the edges of the pterygium, and close to the surface of the sclerotica. The two angles of the wound are then united by two converging incisions, which meet in front of the reflection, and thus enucleate the circumscribed pterygium. The wound is now nearly of a rhomboidal shape." The excision includes a great part of the neoplastic structure, and in large pterygia makes a wound in the conjunctiva so large that its sides should be drawn together with one or more delicate sutures. After the operation the eye should be kept closed with a bandage until the wound is healed. The part of the pterygium left on the cornea soon disappears by absorptive action.

Ligation may be executed in the following manner: "Each end of a silk thread is passed through a delicate, curved needle. The lids being wide open, the pterygium is then seized with the forceps, and lifted up from the sclera. Then one needle is so thrust in at the base of the pterygium, the

other at the margin of the cornea, that they enter at the upper border, hugging the scleral surface, and are then emerged at the lower border of the pterygium. The double thread now forms a noose above; by cutting off the two needles, the thread falls into three parts, an outer, middle, and inner. The inner thread is first tied, then the outer, and lastly the two ends of the middle one. In four days the ligated pterygium is seized by the forceps and removed, together with the ligatures."

FIG. 25.



Method of strangulating a pterygium with ligatures.

Two ligatures carried beneath the pterygium a third of an inch apart and then tied, are as efficient in destroying the neoplastic structure as the three described in the quotation and illustrated in the accompanying diagram. After the knots are tied the free ends may be clipped off. The eye is then kept bandaged for four or five days, to prevent motion of the lids, and the irritation light might cause. The segment of pterygium between the ligatures may then be removed with scissors, and the threads snipped and taken out.

Either of the operations just described is often followed by a partial return of the disease; and in some instances the corneal portion fails to be carried away.

If pterygium can be cured with the caustic application, the result is more satisfactory than an operation. And if the patient neglects to have the caustic applications methodically followed up, the cure may be imperfect. The caustic plan will seldom fail when it is well executed.

The use of ordinary astringent collyria often hastens the growth of a forming pterygium, therefore an inefficient practice should be avoided. If the nitric acid employed be weakened by exposure, the cauterization it produces is not severe enough to arrest the circulation in the pterygium. It is important, too, that the caustic be applied near the cornea,

and in the same spot at each succeeding application. The pain inflicted is keen but momentary. The acid should be limited to the very end of the spatula of wood, as the lids close spasmodically as soon as the caustic is applied, and the tarsal borders would strike against the instrument and receive an escharotic impression, if the stick had acid upon it some distance from the end.

The caustic constringes the vessels, and the cicatrization obliterates them. Absorption subsequently removes a great part of the pterygium.

PINGUECULA, AND FATTY TUMORS OF THE CONJUNCTIVA.—Small tumors, the size of bird shot, near the cornea, between the sclerotica and the conjunctiva, not unfrequently develop after the middle period of life, and are as much a deformity as an inconvenience. Once they were supposed to consist chiefly of fat, hence were called *pinguculæ*. It is now known that they are more fibrous than fatty. They rarely require surgical attention, though they may be easily excised. A slit through the conjunctiva allows of rapid enucleation.

Fatty tumors beneath the conjunctival lining of the lower lid, the size and shape of a bean, and extending from the cornea to the outer canthus, are occasionally met in children. By dividing the conjunctiva and their proper fibrous envelop, the fatty masses are readily turned out of place, and the defect is removed.

CYSTICERCUS TELÆ CELLULOSÆ.—A tumor with vascular surroundings, the size of a pea, between the cornea and the inner canthus, has been known to contain a parasite of the cysticercus variety. A little watery bladder is seen at first, and this becomes enlarged by the irritation produced, more than by the growth of the parasite. The disease is cured by incising the tumor, as the cysticercus is then forced out by the contraction of the tissues. The escaping parasite may be too small to be observed unless the contents of the tumor be caught upon a piece of glass and viewed with a magnifier. The animal is a true tænia, though in an earlier stage of development than those found in the intestinal track.

XEROSIS OF THE CONJUNCTIVA—XEROPHTHALMIA.—A dryness of the conjunctiva caused by cicatrices formed under the prolonged use of escharotics, or by chronic inflammation, has

received the name of *xerosis* or *xerophthalmia*. The secretion of the conjunctiva is very much decreased, and the secretory functions of the lachrymal apparatus seem to partake of the shrinkage. The cornea becomes turbid from the irritation produced by the movements of the roughened lids. The conjunctiva seems to have lost its normal elasticity, and degenerated into cicatrose tissue. The Meibomian glands become partially or entirely obliterated, and the caruncle and semilunar folds shrink or disappear. The cilia drop out, and the borders of the lids appear rough and irritated. A few hot tears escape without moistening or lubricating the parched mucous surfaces.

Treatment.—There is no substantial relief for xerosis. Frequent applications of "cold cream," or other nicely prepared unguents, may mitigate the stiff and dry sensations, but a cure need not be attempted. Pure and neutral glycerine may be employed to advantage to lubricate the lids, yet an inferior preparation is worse than useless.

THE CORNEA.

The cornea and sclerotic constitute a spherical shell which encloses the humors and delicate structures of the inner eye. The sclerotic forms five-sixths of the sphere, and the cornea the remaining one-sixth. The cornea represents the segment of a smaller sphere than that of the sclerotic, and constitutes the anterior, prominent, and transparent portion of the ocular capsule. In shape the cornea is slightly oval, the vertical diameter being less than the transverse, a variation which arises from the overlapping of the sclerotic along the superior and inferior margins. The cornea is concavo-convex, and projects forward from the sclerotic in the same manner that a watch-glass does from its case. During youth the cornea is more convex than in advanced life when it becomes flattened. The degree of convexity influences refraction—a flattened cornea makes vision *long*, and a prominently convex one *short*.

The cornea consists of five layers, all of which are perfectly transparent. The central part is fibrous and tough, being

identical with the sclerotic, with which it is continuous; in front of the central structure is the anterior elastic lamina, and this is overlaid by the conjunctival layer; behind the central body is the posterior elastic lamina, and this is lined by the delicate membrane of *Descemet*, against which the aqueous humor presses in front.

The cornea ordinarily is a non-vascular structure, the capillary vessels terminating in loops at its circumferance. Branches of the ciliary nerves ramify in its entire substance.

ARCUS SENILIS.—In many persons at the age of forty or fifty, an opaque whitish crescent may be observed skirting the margin of the cornea, especially above. In some old persons, the crescentic stripe is chalky white, and very striking in appearance. This white zone is produced by fatty degeneration; and so far as the eye itself is concerned, the transformation may be considered as of very little importance. Whether "arcus senilis" indicates a tendency to general fatty degeneration is a question. The opaque zone is at a little distance from the sclerotic, a narrow ring of partially clear cornea intervening. The entire thickness of the cornea is not involved in the fatty transformation, therefore a wound made in the opaque crescent for the extraction of cataract, will firmly unite, though not quite so readily.

CONICAL CORNEA.—Through some cause not well defined the cornea becomes changed from the segment of a sphere to a cone. The change in shape does not affect the transparency of the medium. Persons in good health, without peculiarities in habits or employments, are not exempt from the defect.

The aspect of a patient with conical cornea is so peculiar, that when once seen, the affection is not likely afterwards to be overlooked. The eye, viewed in front, has a brilliant and sparkling appearance, as if a tear were hanging just in front of the pupil. When seen in profile, the conical shape of the cornea is at once recognized. No other tissue is complicated with the affection. The very apex of the cone appears hazy, but this is due to refraction, and not to friction of the lids.

As the cornea grows conical the patient becomes short-sighted; and at length, as the cone gets prominent, a remarkable refraction of the rays of light is produced. The flame of a candle appears surrounded with a halo, with a multitude

of diverging rays; and instead of a single flame several are seen, arranged in a circle. When the worst stage of conical cornea is reached, the patient can not read, even at the shortest focus.

No efficient and satisfactory treatment has yet been devised for the cure of conical cornea. Paracentesis, pressure, displacement of the pupil, and other operations have been performed, but all without benefit. Astringent lotions are frequently worse than useless, actually inflicting harm. Internal remedies are ineffectual.

Optical contrivances have been employed, but with indifferent results. A pin-hole aperture in a metallic plate, held close to the eye, will enable a patient to read at a focus of five or six inches. A slit three-quarters of an inch long and the thirtieth of an inch wide, in a plate fitted to a spectacle frame, enables the patient to enjoy a lateral range of vision without moving the head in the way which is necessary when objects are viewed through a small circular aperture.

KERATITIS (Corneitis).—When the cornea is inflamed, instead of being perfectly transparent, smooth, and brilliant, as it normally is, it loses those qualities, and becomes hazy, its surface appearing like glass bedimmed with the breath. The cloudiness generally proceeds from the margin of the cornea towards the centre. If the inflammation be acute, crescentic plexuses of vessels soon make their way from the edge of the cornea into its substance. These vessels are so fine, and so closely set together, that they appear like a vascular ring or zone at the margin of the cornea. Viewed with a good magnifier the loops of vessels constituting the plexuses may be identified. Branches spring from the vascular loops, and push towards the centre of the cornea, increasing the opacity as they proceed. A zone of pink vessels appears in the sclerotic bordering the cornea, as it does in iritis. Active keratitis can not long exist without complicating the conjunctiva and other structures in the inflammatory invasion.

Dimness of vision attends keratitis, as well as intolerance of light, lachrymation, and more or less pain. The pupil contracts through sympathetic action of irritated nerves, and even the lids are disposed to contract spasmodically from the same cause.

One eye is usually attacked at a time, and the other rarely

escapes, though the first invaded may begin to recover before the second has reached the worst stage. The course of the disease is variable. An attack may last only a few days, or continue for months, becoming chronic.

Children and young subjects are most liable to keratitis, the disease being rare after the nubile age. The feeble, the irritable, the scrofulous and the anæmic, are most frequently victims to corneal inflammation. Keratitis is also a frequent accompaniment of herpes, conjunctivitis, and trachoma. Mechanical injuries of the cornea, including the irritating presence of foreign bodies, inverted cilia and chemical vapors, are sure to be followed by keratitis.

The verminous diathesis is often attended with keratitis and corneal ulcers. Catamenial disorder, and derangements of the sexual functions may be enumerated as among the provocatives of corneal inflammation.

Keratitis in its simplest forms may not last but a few days, especially if the cause be removed; yet it is not uncommon for attacks to become tedious, and disastrous to vision. A superficial cloudiness in a young subject readily disappears as soon as the inflammation subsides, but deeper opacities in older persons may always remain.

Treatment.—When keratitis is evidently produced by constitutional disturbances, or systemic vices, nothing could seem more rational than to administer such remedies of an alterative nature as promise to effect a change for the better in the digestive, assimilative, and secernent organs. The iodides, sulphur, sarsaparilla, blue flag, iron, cod liver oil, and arsenic, sustain the best reputation for dispersing tetter, scrofula, tubercle, and kindred constitutional vices. The waters of certain springs, change of climate, diet, and exercise, are not to be forgotten nor neglected in the skillful management of chronic cases of keratitis.

The local treatment of keratitis should be managed with discretion. The popular demand for washes and salves should be curbed and thwarted. A colored water lotion may serve to amuse and sustain confidence. A grain of morphia in an ounce of water, to which may sometimes be added a drop of aromatic sulphuric acid or compound tincture of lavender, constitutes a collyrium of some value in reducing irritability of the eye and diminishing photophobia.

Of course, the eye is to be very carefully examined to see if a foregn body beneath the upper lid or in the substance of the cornea, be doing the mischief. It would be unpardonable to overlook a foreign body which was keeping up the irritation, and worse than waste time to prolong fruitless medication.

In chronic cases of keratitis where vessels, plainly visible, have channeled the entire meridian of the cornea, the local treatment must be especially directed to the arrest of the fortuitous circulation. This can be safely and effectually done in a few weeks by applying nitric acid to the principal trunks at the sclero-corneal junction every four or five days. The acid at full commercial strength can be applied with a pencil of soft wood, as follows: a splinter of wood whittled to a small yet blunt point, is dipped in the acid, and then withdrawn. In a minute or two the stick will appear dry, yet contain acid enough to cauterize, and is ready for use. The upper lid is now to be raised sufficiently to expose the cornea, and the pencil applied to the largest vessel as it enters the cornea. If several quite prominent vessels exist, the pencil may be applied to each. The largest vessel usually enters the cornea on the nasal side, but several large ones may come down from above. Quite small vessels may be let alone if the large ones are attacked. The object is to constringe the main vessels, or even to make an eschar of them at a point where they enter the cornea. The application causes sharp momentary pain, but no lasting disagreeable effect. The application should not be repeated oftener than every four or five days. During the intervals the patient may be amused with the use of a harmless lotion. If a small scar is left at the edge of the cornea it will do no harm as it is outside the field of vision. Acid which has been long kept in the light, and in a vial stopped with cork, is unfit for use. It is then an irritant and not a caustic. I know of no other efficient means of cutting off from the cornea a fortuitous circulation. I have divided and even excised the vessels at the border of the cornea, but the results were not generally satisfactory. No other active caustic, applied in any other way, is controllable. By this method the action is confined to a point or circumscribed spot. No other part is injured A strong solution of nitrate of silver, applied with a camel's-hair brush would

spread, and do mischief. The point of a sulphate of copper crayon is not reliable.

Keratitis is sometimes accompanied with trachoma, which is a complication needing special treatment, so far as the granulations are concerned.

HERPES CORNEÆ.—Young persons of a scrofulous or herpetic diathesis are liable to have vesicles develop on the cornea. The vesicles are about the size of poppy seed, and may burst, and their cavities become minute ulcers. An attack of herpes corneæ is usually ushered in with conjunctival congestion, photophobia and lachrymation, the tears seeming to scald. Pain is always an accompaniment and in some cases is excessive. The vesicular efflorescence and lachrymation impair vision.

Herpes corneæ is aggravated, if not developed, by enfeebled digestion, lack of proper nourishment, despondency, and unpleasant surroundings. The disease may run its course in a few days, or continue for weeks or even months. It may terminate in recovery, or leave the cornea more or less opaque. Before its career is ended, the conjunctiva and the deeper ocular structures may become involved in the morbid action.

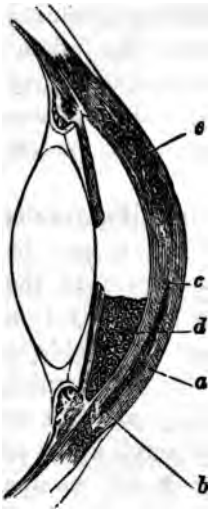
Treatment.—As herpes corneæ seems to depend considerably upon a constitutional vice, its treatment would seem to call for proper systemic medication. The use of sulphur alone, or combined with sulphate of magnesia and cubebs, is a good remedy to employ. Fowler's solution of arsenic in one or two drop doses every four hours, has benefitted debilitated cases, where digestion and assimilation were defective. The iodides of potassium and ammonium, when administered so as not to disturb the stomach, are valuable alteratives, and may be given in scrofulous cases.

Local applications are to be prescribed with discretion. Ten drops of Fowler's solution to an ounce of glycerine, may be used as a lotion to destroy the herpetic virus. A very dilute chlorinated wash can be employed for the same purpose. Caustics and irritants are to be avoided; also poultices and ferments. Warm applications are agreeable, but those which are cold are safest. Aconite and laudanum used about the eye tend to lull the pain, and to lessen the lachrymal secretion. The eyes should be shaded, but not heavily cov-

ered. A strip of flannel tied over the eyes forms an elastic protection.

The course of the disease, whatever be the treatment, is apt to be attended with exacerbations and remissions, keeping the patient and friends in a state of vibration between hopes and fears.

FIG 26.



Hypopyon, or pus in the anterior chamber *d*; abscess of cornea is represented by *e*; and onyx by *a*; a layer of pus in an interlamellar space reaches from *b* to *c*.

SUPPURATIVE KERATITIS.— Inflammation of the cornea, instead of terminating in resolution, doing little harm, may, under certain conditions of the patient's system, run a very acute and rapid course, and terminate in abscess or ulceration. When suppuration takes place in the cornea, it is most frequently at the centre, or a little below that point, that the pus collects. Its presence is usually manifested by a yellowish patch in the midst of a general haziness. In very severe cases this yellow patch may rapidly spread, until the whole cornea assumes one uniform creamy tint, hiding every trace of the iris. At this stage of the disease the cornea softens, the iris prolapses through a rent, and vision is lost. If the abscess be in the deeper layers of the cornea, the pus gravitates downwards or bursts into the anterior chamber, and, sinking, forms *onyx* or *hypopyon*.

Neuralgia of the branches of the *fifth pair* of nerves, and consequent paralysis, are often the cause of suppurative keratitis and ulceration of the cornea. I have observed a destructive keratitis to attend cerebro-spinal meningitis. Severe conjunctivitis, especially the gonorrhœal variety, is attended with dangerous inflammation of the cornea, especially when there is much chemosis. Some of the acute forms of keratitis, particularly those of gonorrhœal or diphtheritic origin, are rapidly destructive, the cornea deliquescing in a few hours. In panophthalmitis following wounds of the eye and cataract operations, the cornea softens in a short time, and frequently bursts, allowing the iris to protrude.

Treatment.—The walls of the cornea are too thin to permit a circumscribed abscess, but the pus gets infiltrated between

the layers, and is too much diffused to warrant puncture as do ordinary abscesses. If an incision were made to give exit to the pus, the pressure from within at that point might result in a staphylomatous state, or rupture of the remaining thin portion of the cornea. It is therefore best to let the abscess take care of itself.

In most instances of acute suppurative keratitis not much can be done to avert serious consequences. Attention may be directed to sustain the general health The febrile excitement may be restrained with veratrum; and as soon as the inflammation shows signs of abating, quinine and mineral acids may be prescribed to advantage. If the cornea bursts, the aqueous humor escapes and the violence of the inflammatory storm subsides, though vision can not often be saved.

In the chronic forms of suppurative keratitis, the results are not so disastrous. Neuralgia of the fifth nerve may be allayed by the application of aconite and chloroform to the integument about the eye. In many instances the ulceration is not fatal to vision. But if the cornea softens and yields to pressure from within the lids should be kept closed to furnish support to the weakened corneal structure. Any attempt to return a portion of iris which has prolapsed through a loss of substance in the cornea, is utterly futile; for it will escape again and again, so long as there exists an aperture to escape through. A portion of iris adhering to the cicatrix of a perforated cornea and protruding beyond the level of the corneal tissue, may be snipped off with scissors, or lightly touched with caustic.

ULCERS OF THE CORNEA.—Ulceration of the cornea must obviously result in corneal ulcers. In purulent, scrofulous, and other severe types of conjunctivitis, there is danger of corneal ulceration; and in the more simple forms of circumscribed keratitis, ulcers of the cornea may be developed.

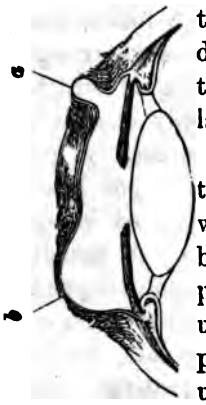
A recent ulcer of the cornea, in which the destructive process is still going on, exhibits a sharply-cut, well defined edge, with little, if any, surrounding opacity; and the excavation itself, as regards transparency, offers but little contrast to the sound corneal tissue.

Ulcers of the cornea sometimes heal without filling up, so that the cicatrix presents a slight depression which the inexperienced observer might take for an existing ulcer, and

damagingly attack with active treatment. While the healing process is going on, there is more or less opacity in and around the ulcer; and if the ulcer be large, vessels will be seen running to it from the margin of the cornea. The cicatrix of a healed ulcer has its edges smoothly rounded off, and its area is slightly opaque. A magnifying glass reveals the true cicatritial structure, and no pus can be seen within its borders.

If the progress of an ulcer be not arrested, it may eventually perforate the whole thickness of the cornea. The aqueous humor then escapes, the iris falls against the cornea, so that the anterior chamber becomes altogether obliterated; a portion of iris—large or small, according to the size of the perforation—protrudes through the opening, towards which also the pupil is displaced. If the *prolapsus iridis* be very large, the whole area of the pupil may be annihilated.

FIG. 27.



Results of suppuration of the cornea; *a* represents a segment of the cornea thinned to a "vesicle."

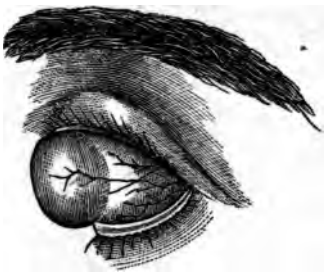
In rare cases the ulceration reaches only to the posterior elastic lamina of the cornea, which, in consequence of the pressure from behind, is thrust forwards as an almost transparent vesicle filling up the cavity of the ulcer. The term *hernia corneæ* has been applied to this protrusion. Such a condition is unfavorable to vision.

Ulcers of the cornea may heal without opacity, though generally they do not. Under favorable circumstances children escape opaque cicatrices, the excavations filling up with transparent corneal tissue, and disappearing without serious obstacles to vision. Large ulcers are apt to permit bulging where the corneal walls are thinnest, constituting staphyloma. In some instances the projection is so great that the lids can not be closed, and the tumor collects floating particles which prove a source of chronic irritation. The iris becoming involved in the inflammatory action, adheres to the posterior surface of the cornea (anterior synechia), and forms part of the staphyloma. In rare cases the cornea being nearly lost by ulceration, and the pupil having been occluded with organized lymph, the iris constitutes the chief part of the protrusion.

Treatment.—Ulcers of the cornea being frequently the result

of general debility, local treatment alone is not sufficient, but constitutional improvement is to be sought. A nutritious diet is not to be neglected; and digestion and assimilation are to be aided by the judicious use of iron, bitter tonics, mineral acids, sulphur, phosphorus, iodoform, cod liver oil, pepsin, and other agents known to improve the general health.

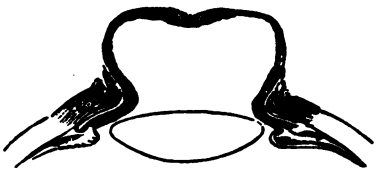
FIG. 28.



Staphyloma.

Locally lead lotions should not be used, as they are apt to leave permanent deposits in the ragged edges of the ulcers. Nitrate of silver solutions are open to the same objections. A lotion made of glycerine and rose water, equal parts, to each ounce of which is added a drop or two of nitric acid, commonly checks the ulcerative action, and favors the reparative process. A grain of chloride of zinc and a drop of muriatic acid put into an ounce of rose water or glycerine, or both combined in equal parts, make a suitable wash for corneal ulcers. A pencil of wood with its point dipped in nitric acid, and after no wetness is observable, touched to an excavating ulcer, arrests the disintegrating process, and imparts to it a healing disposition.

FIG. 29.



Cornea thinned by ulceration, and iris adhered to it, constituting a form of anterior synechia.

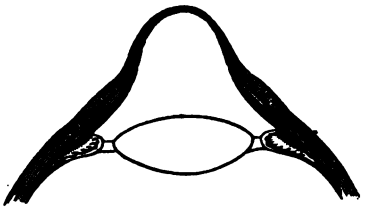
The object of the treatment is to limit and suppress the suppuration, to favor reparation, and to prevent secondary accidents and the worst results. To effect these objects the local applications should be weak, or, occasionally, an efficient caustic. Quite astringent and irritating lotions should be avoided.

Bulging of the cornea may be obviated to some extent by the use of a "protective or pressure bandage," or by holding the lids closed with adhesive strips. Compresses render the dressing hot and heavy. When perforation is threatened the iris should be kept out of the wound if possible. Should the ulcer be near the centre of the cornea, mydriatics may be used

to dilate the pupil; if the ulcer be near the periphery, preparations of calabar bean may be employed to contract the pupil.

Corneal staphyloma is to be treated according to the extent of the distortion and protrusion. If the corneal curvature be slightly increased, the curves being deviated enough to afford different foci, and the irregular focal lines and surfaces incline to each other in varied directions, the retina receives a number of figures of dispersion, instead of images of objects, and a state of *astigmatism* exists. This condition is to be corrected as far as possible with spherical glasses.

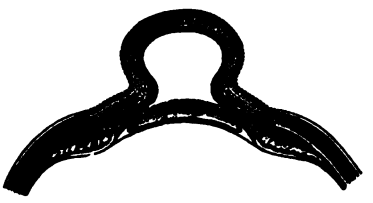
FIG. 30.



Staphyloma, with thinning of the cornea.

A staphylomatous protrusion always occurs at the expense of the thickness of the cornea; and the thinned walls are not unfrequently cicatrized and opaque. In some cases, where the protrusion has existed for some time, the summit of the staphyloma grows thick under prolonged irritation, but the thickening is a secondary condition. It has been recommended to puncture these staphylomatous protrusions, to permit the aqueous humor to escape, and thereby flatten the protrusion sufficiently to allow the lids to cover the tumor. But, it is found that the paracentesis affords only temporary relief, the aqueous fluid being reproduced and the protrusion re-established. It is better, therefore, to excise the staphylomatous mass. This operation of excision may be performed as follows: an upward incision is made with a Daviel's knife, much as the corneal wound was once made in the linear extraction of cataract; the flap is then seized with forceps and the downward cut made with a bistoury or Graefe's knife, care being exercised in terminating the incisions that lips remain to fall towards one another, to form a

FIG. 31.

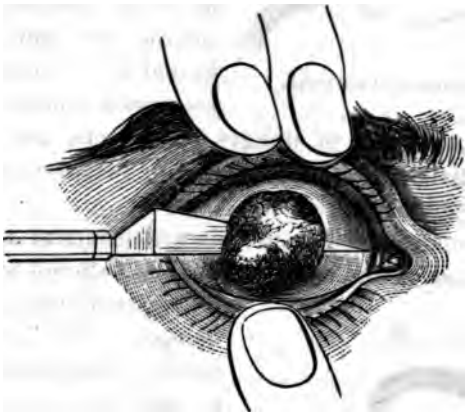


Staphyloma, with protruded cornea thickened.

linear cicatrix. The lens is then removed carefully, and the lids closed. A compress is to be placed on the eye and retained with a pressure-bandage to guard against evacuation of the vitreous, and hemorrhage. The operation should be performed while the patient is under chloroform. The part excised will show the iris upon its posterior surface; and the dislodged lens will appear fatty, or chalky.

Another method of operating is to split the staphyloma

FIG. 32.



Ablation or excision of a staphyloma.

through the middle, evacuate the aqueous, and bring the edges of the wound together, or allow them, in some instances, to overlap. This operation is recommended in thin-walled staphylomata, and especially those made up chiefly of iris. In such cases the overlapped walls add strength to the weakened structures.

Mr. Critchett advises that an eliptical piece be excised from the staphylomatous cornea, and the edges of the wound be brought together with sutures, the protrusion being transfixed with needles before the excision is made. The needles are to be armed with silk threads which are to be drawn through and tied as soon as the excision is performed. The object of this operation is to evacuate the aqueous, and to retain the vitreous and lens. The advocate of the plan claims that the stump can always be secured of proper size to sustain an artificial eye.

OPACITIES OF THE CORNEA.—Inflammatory changes in the corneal tissue frequently result in opaque spots, or in haziness or cloudiness of the entire cornea (partial or complete leucoma.) The opacity may be confined to the superficial layer of the cornea, or extend to its deeper structures. The opacities often appear like fleecy clouds resting upon the polished cornea. The popular term of "feather on the sight" is somewhat expressive. Frequently the opacity is so delicate that it appears like haze or smoke, and needs a careful examination to be detected. An oblique light thrown through a convex lens helps to discover the more obscure of corneal opacities. The more prominent can be recognized at a glance.

It is important to make a distinction between opacities which from their cicatritial nature are permanent, and a hazy condition of the cornea which, if promptly and skillfully treated, may be entirely removed. A cloudy condition of the cornea which has existed only a few days or weeks, and depends upon simple keratitis, with a vascular zone in the sclerotic, and some degree of irritability of the eye, may be cured very speedily; but if the general haziness has existed some months or years, with no sclerotic redness, or signs of inflammation in the eye, it is likely to be incurable.

FIG. 33.

Cicatrix of cornea involving the iris.

When the cicatrix involves the whole thickness of the cornea, and has attached to it a greater or less portion of iris, the nature of the opacity is marked by a black spot, and by the change of position in the iris and pupil. The anterior synechia in such a case is a serious complication, the optic apparatus being considerably distorted.

Disturbance of vision is a constant accompaniment of all opacities which fall in the slightest degree over the pupil; but nebular spots near the border of the cornea do little or no harm. A nebula near the centre of the cornea causes the eye to roll sufficiently to throw the opacity out of the axis of vision, and strabismus is the result. A squint from such a

cause is permanent; at least, no attempt should be made to rectify it.

Whether the corneal opacities exist as *nebulæ*, *albugo*, or *leucoma*, for these several names have been given to designate differences in the density and character of the opacities, they have no power to change into transparent tissue; but sometimes become diaphanous, especially in young subjects, and to interfere less and less with vision.

Opacities of the cornea disturb vision in various ways. They compel the patient to bring objects quite near the eye, and cause a strain of accommodation which results in myopia. Besides, an eye which is impaired, whether from defects in the cornea or other structures, is neglected, and the functional inactivity leads to greater and greater feebleness in the retina.

Treatment.—It has been stated that an opacity resulting from a cicatrix can not be changed into transparent tissue. But in young patients it is quite astonishing to witness the rapid interchange of material in leucoma resulting from keratitis, and ulceration of the cornea.

A solution of the iodide of ammonium—a grain of the salt to an ounce of water—may be applied to nebulæ with some hope of benefit. Neither alkaline nor acid washes, as such, are known to effect more than neutral applications. It is customary for some oculists to apply dry calomel to corneal opacities, but no special impression is produced by the agent. If any preparation of mercury would accomplish any good purpose when applied to the eye—as wash or unguent—the quantity employed would be so minute that no harm could arise from absorption. The idea that mercury is a solvent of adventitious deposits is not well established. Solutions of lead and nitrate of silver should not be applied lest insoluble deposits adhere to the irregularities of the cicatritial tissue.

The application of finely powdered sulphate of soda directly to albugo or leucoma has been reported to produce wonderful results. M. de Luca claims that the agent has the power of removing corneal spots in an almost incredibly short space of time. A solution of chloride of sodium (common salt) has been advocated as an efficient agent in the removal of corneal opacities.

The transferring of the pupil, by iridectomy, from a position behind a central opacity, to a point where the cornea is

transparent, is an operation entirely legitimate in cases favoring such an operative procedure. When vision in one eye is irrevocably lost, and an artificial pupil in the other promises anything, the operation should be performed.

INJURIES OF THE CORNEA—*Abrasion.*—The epithelial layer of the cornea is often lacerated by the forcible contact of rough substances; and sometimes a little flap of epithelium is partially detached and doubled over. The injury may seem insignificant to the casual observer, but the patient experiences intense pain and is a proper subject for careful treatment.

Abrasions and lacerations of the outer layer of corneal tissue should be examined with a magnifying-glass, the patient being in a good light. The careless and inattentive often fail to detect the cause of the pain and irritation. As already stated, keratitis more or less severe is likely to follow corneal abrasions.

The treatment consists in keeping the eye bandaged for a day or two, to prevent motion of the lids. A drop of olive oil applied to the abraded surface every few hours is commended. As soon as the epithelium is regenerated all irritation ceases, and the uniform polish of the cornea is restored. Bad cases may be attended with suppuration, and be followed by an opaque cicatrix.

CONTUSION OF THE CORNEA is an injury not attended with abrasion, but is often produced by a whip, or stick, or missile. Ordinarily such injuries are merely painful, no lasting effect being observed. However, in the severer forms of contusion, suppuration and softening of the cornea occur, and serious inflammation of the deep structures of the eye is to be feared. Young subjects recover without much trouble, unless it be temporary haziness of the cornea, but old persons are not so fortunate, the cornea after softening gives way, and allows the aqueous humor to escape. The globe, in such cases, shrinks, or a troublesome staphyloma forms. Contusion of the cornea, then, should be regarded as a serious accident, and managed accordingly.

The treatment is not necessarily different from that indicated for corneal abrasion. The light should be shut out and the lids kept from moving by the use of a bandage and light compress. The tincture of aconite may be applied to the in-

tegument about the eye; and a chloral anodyne may be prescribed for internal use to modify the pain, the shock, and the nervous excitement.

INCISED AND PUNCTURED WOUNDS.—A smart blow with a stick will sometimes inflict on the cornea a cut as clean as if made with a knife. Such wounds are more serious than those purely of an incised character, inasmuch as the shock is greater, and the inflammatory process more severe and longer continued, often ending in complete disorganization of ocular structures.

Small, sharp bodies, such as fragments of glass or metal, when driven with great rapidity against the cornea, frequently produce so small a wound, that a physician unaccustomed to see such cases may easily underrate the size of the foreign body inflicting the injury; the elasticity of the cornea causes the wound to contract as soon as the foreign body has passed through. As soon as such an injury has occurred the iris should be carefully scrutinized, as well as the bottom of the anterior chamber, in order to detect the whereabouts of the penetrating missile; and if the cornea be still transparent, and the aqueous humor retained, the pupil should be dilated with atropine; and the lens and deeper tissues explored with an ophthalmoscope. If any portion of the penetrating body protrude from the wound, it should at once be extracted with a delicate well-closing forceps, the lids being held apart with a spring speculum, and the globe steadied by nipping up a fold of conjunctiva covering the sclerotic. If the foreign body be lodged in the iris, the cornea should be incised with a lance-shaped knife, and iridectomy performed, that part of the iris being removed which embraces the foreign substance. Should the foreign body be discovered in the lens, a cataract operation must be performed at once.

The corneal wound may permit the iris to protrude; and if not returned with a probe or small spatula, the prolapsed portion of iris will unite to the borders of the corneal wound. A protruded portion of iris, which can not be returned, may be snipped off with curved scissors.

Penetrating wounds may transfix the cornea, and, as has been stated, reach the iris and lens. But more common and simple wounds are punctures of the cornea made by sharp

pieces of metal which lodge in the outer corneal layers. Grains of gun-powder, particles of sand, bits of steel, and cinders are most frequently projected with force into the substance of the cornea. Machinists, metal-turners, mill-stone dressers, stokers, foundry and furnace-men often suffer from such accidents; and the medical practitioner, while examining a wound of the cornea recently inflicted, often finds cicatrices and particles of foreign matter which have long been buried in the cornea and have ceased to be troublesome.

A good degree of patience and skill is frequently required to remove or extract a foreign body from the cornea. If a slender bit of steel bury itself in the cornea too deeply to be reached with a delicate lever or forceps, attempts to reach it may result in forcing the foreign body within the anterior chamber, where it may become entangled among the fibres of the iris. If an elongated chip of metal strike the eye obliquely, it sometimes lodges in the cornea at about the middle of its thickness. Now, if the lodgement be recent, the missile can be seen, though affording no hold for forceps. Under such circumstances, the operator may with a cataract needle or slender knife slit up the outer corneal covering, when the foreign body may be dislodged with ease.

Some patients can not hold the eye sufficiently steady to allow the operator to effect a removal of the offending body. Such persons should be put under the influence of chloroform; and then proper manipulations can be executed without trouble. I sometimes use the point of a slender bistoury to dislodge a piece of metal which is embedded in the corneal tissue. A cataract needle may be employed for the same purpose. The wound made by the penetration of the foreign body, and the moderate injury inflicted in the process of extraction, are generally obliterated in a few days by reparative action, though a small cicatrix may be lasting. The suffering eye should be kept bandaged for a day or two, and the other not subjected to active exertion. In severe cases where the cornea is transfixed the treatment should be managed with the greatest care and attention, until all danger from inflammation is passed. Severe pain is to be restrained with anodynes, and the eyes should be protected from light.

DISEASES OF THE SCLEROTIC.

The dense capsule which forms five-sixths of a sphere, and gives form to the eye and support to the soft structures within, and also affords attachment to muscles without, is, from its hardness, called sclera or sclerotic. The remaining sixth of the globe is a transparent structure—the cornea. The sclerotic is a fibrous tunic, very firm, opaque, and thicker behind than in front. Near the corneo-scleral junction where the tendons of the recti muscles are inserted, the sclerotic, though covered with conjunctiva, presents a glistening white band or zone behind the cornea, called the "white of the eye." The optic nerve pierces the sclerotic posteriorly, a little to the inner or nasal side. The sheath of the nerve is a prolongation of the dura mater, and the sclerotic seems to be an expansion of the neurilemma.

The sclerotic, when inflamed, exhibits a zone of vascularity close around the margin of the cornea,. It is probable that sclerotitis never exists independently of inflammation of other structures. Keratitis must necessarily be complicated with sclerotitis. And the sclera is sympathetically affected in choroiditis.

The sclerotic can not be observed as a whole when inflamed, but the zone covered with conjunctiva presents a peculiar pink tint, sometimes with a shade of violet; and pain, intolerance of light, and lachrymation are pretty constant attendants of sclerotitis. In sclero-keratitis, and sclero-choroiditis, which are frequent combinations of morbid action, the symptoms are more marked or observable.

Rheumatic subjects are liable to a chronic form of sclerotitis, the inflammation being confined to the anterior zone, close to the cornea. This variety of scleral inflammation is apt to involve the cornea and the iris, and according to some ophthalmic writers, the ciliary body, making sclero-cyklitis.

Treatment.—The general health should be kept good by a suitable diet, and the use of nux, cinchona, and other bitter tonics. The bowels are not to be scoured with cathartics, but moved easily with the aid of sulphur and sulphate of magnesia, an aromatic being added. In rheumatic and neuralgic states, macrotys, and the iodides of potassium and

ammonium, are excellent remedial agents. The parts about the eye may be wetted every hour or two with chloroform. A pungent snuff, composed of bayberry, veratrum and sassafras, and used occasionally, exerts a beneficial effect. The eyes should not be exposed to brilliant lights, and may be shaded with tinted spectacles.

If the sclerotitis be complicated with iritis, retinitis, and choroiditis, as it generally is, the remedies employed in those diseases, may be tried. By comparison it will be seen that there is a similarity in the treatment recommended for all of these difficulties.

INJURIES OF THE SCLEROTIC.—A simple wound of the sclerotic, the parts within the globe remaining untouched, is not likely to terminate seriously, unless a foreign body of an irritating nature continue in the wound to provoke inflammatory attacks. But if a bird-shot or piece of metal enter the globe, the injury to the choroid, retina, and vitreous body, is sure to be followed by inflammation which proves destructive to vision.

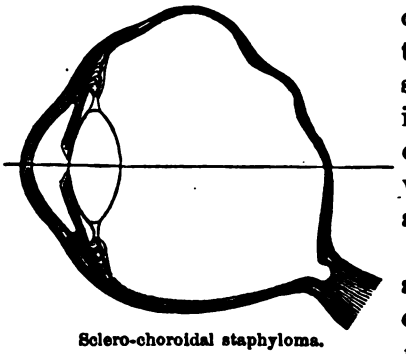
A serious and singular injury to the sclerotic consists in its rupture near the sclero-corneal junction by the force of a counter-stroke. The punch of a cane or similar weapon against, say, the outer side of the eyeball, bursts the sclerotic on the opposite side, and the lens slips through the rupture and lodges beneath the conjunctiva, which, yielding, escapes laceration. Such a force may inflict additional injury to the eye, such as hernia of the iris and portions of the choroid and retina. The dislocated lens could be removed through an incision in the conjunctiva; but in the more complicated of injuries the surgeon is to be governed by circumstances. After the effused blood has been let out, the hernied iris or choroid might be snipped off with scissors, and the patient, with the eye closely shaded, kept at rest and free from influences unfavorable to recuperation of the eye. The chances for useful vision, however, are exceedingly slender.

SCLERAL OR SCLERO-CHOROIDAL STAPHYLOMA.—A thinning or yielding of the sclerotic at some point, and a consequent bulging of the scleral walls, constitute what is called *staphyloma*. The choroid is intimately connected with the sclerotic,

therefore the sclera, when it yields and bulges, usually takes the choroid along with it, constituting what is termed *sclero-choroidal staphyloma.*

The staphylomatous condition may extend to the entire globe, ruining the dioptric apparatus by displacing and distorting every structure entering into the formation of the eyeball; but it oftener affects only a part of the scleral tunic. If the protrusion be far enough in front to be observed, it will appear as a bluish or slate-gray transparent nodule or tumor, projecting above the surrounding sclera. In some instances the protruding mass is furrowed or divided into a series of elevations, giving it the appearance of a cluster of grapes.

FIG. 34.



Sclero-choroidal staphyloma.

Ophthalmoscopic examination of a staphylomatous eye usually shows inflammatory changes in the choroid and retina, cloudiness of the dioptric media, and fluidity of the vitreous. As a result of these changes, vision is entirely destroyed, or limited to a quantitative perception of light. If the scleral staphyloma be pretty well in front, and not extensive, the posterior portions of the retina may preserve their functions, vision being only slightly impaired.

Scleral staphyloma may burst spontaneously, or as the result of a blow. As a consequence the contents of the globe are evacuated, and more or less hemorrhage occurs. At length the rent heals; and atrophy is the termination of morbid action.

Treatment.—As soon as it be discovered that scleral staphyloma exists, the intraocular pressure should be relieved by daily paracentesis of the cornea. It has been advised to perform iridectomy, though the object of the operation is chiefly to evacuate the aqueous chamber, and thereby relieve the intraocular pressure. It is an established fact that iridectomy is followed by more lasting results than paracentesis.

The progress of scleral staphyloma may be arrested in some instances by slitting the tumor. A large opening could

not be made in the sclerotic without endangering a too free evacuation of the vitreous and intraocular hemorrhage, therefore some caution should be exercised in the performance of the operation, and, afterwards, by employing a protective bandage to give support to the vessels within the globe.

Sometimes the wound made by slitting the tumor heals rapidly, and the staphyloma appears again in its former shape. When such is the case, a repetition of the operation is necessary.

In total sclero-choroidal staphyloma it has been recently recommended to bring about suppuration of the globe, and subsequent atrophy, by passing one or more threads through the sclera and vitreous in the ciliary region. The threads are to be left in place from one to three days, or until an active degree of inflammation has been provoked. There is danger of provoking too much inflammation; and when such be a result, efforts must be made to subdue it.

THE IRIS.

The iris is a circular diaphragm which is placed between the cornea and the lens. It has a central aperture called the pupil, the diameters of which are regulated by muscular fibres in the substance of the iris. The pupil is an open communication between the anterior and posterior chambers, the aqueous humor flowing freely through the aperture.

The peripheral border of the iris is attached to the ciliary muscle and processes; and its pupillary edge rests posteriorly against the capsule of the lens. When the pupil is contracted the convexity of the lens bulges the pupillary margin forwards; and when it is dilated its borders do not touch the capsule of the lens.

The pigment—*uvea* or *tapetum*—on the posterior surface of the iris, gives color to the eye. In the fair and light-brown races of mankind the pigment of the iris is bluish-gray; and in the dark skinned it is black. A particolored or variegated iris is very common as may be learned in attempts to find a match for the real eye from an assortment of artificial eyes.

The vessels of the eye are abundant, producing the beautiful radiate appearance which is especially marked in light colored eyes.

The nerves of the iris are chiefly branches of the trifacial (5th) and oculo-motorius (3d); a filament of the sympathetic is also sent to the iris; and nerve-supplies come from other sources.

Muscular fibres, generally running in a circular manner, contribute to the structure of the iris; and a bundle near the pupil constitutes a sphincter apparatus. Radiate muscular fibres, as dilators of the pupil, have been described, yet they are so delicate and pale that they may be merely connective tissue, elastic enough to widen the pupil when the circular fibres are benumbed or paralyzed. Congenital defects of the iris, as of other structures, are occasionally met; *irideremia* is the term given to denote a total absence of the iris. A child without irides shrinks from strong light, and exhibits much unsteadiness of the globes. When carefully examined in a favorable light, the whole space behind the cornea presents a uniform red or orange tint, and the edge of the lens is defined by a ring of golden light.

Congenital coloboma is a malformation which results from an arrest of development, the two halves of the iris not meeting and blending. The pupillary aperture, under such circumstances, presents an elongated form, the fissure extending down to the lower edge of the cornea. *Coloboma iridis* usually coexists in both eyes, and the defect may be a little to one side of the median plane.

In rare cases the pupil is placed near the margin of the cornea, instead of occupying a central position in the iris. Malposition of the lens may accompany this eccentric position of the pupil.

In the *Albino* the iris exhibits the general want of pigment which characterizes the hair and skin. The layer of opaque pigment, termed *uvea*, is altogether wanting, and the structure of the iris presents a singular appearance, as if loosened by maceration. White fibres are intermixed with others of a lilac color, and through the whole attenuated iris the light reflected from the fundus of the eye transmits a reddish glow.

Albinism is frequently attended with defective vision, and always with great intolerance of light. In some cases, how-

ever, sight is very good, and extreme sensibility to light is the only cause of complaint.

IRITIS.—Tremulousness of the iris, and a deviation from the circular form of the pupil, are to be regarded with some suspicion, though neither of them is a positive pathognomonic sign. Diminished mobility of the pupil, a loss of the peculiar fibrous appearance of the iris, and a well-marked sclerotic zone, furnish additional evidence of iritis. Nodular excrescences and granulations on the surface of the iris commonly indicate inflammatory action. Iritis is frequently complicated with inflammation of the cornea, sclerotic, choroid and retina, or is a part of panophthalmitis. Blue and gray irides, when inflamed, change to a dirty slate or yellowish green color; and black and brown irides, to an ochre or cinnamon red.

Great sluggishness, or complete immobility of the pupil, is an essential feature of iritis, therefore if the pupil be mobile the iris is not seriously inflamed. In order to test the reaction of the iris, the patient should be placed in a moderately strong light, and the unaffected eye should be closed with a folded cloth, so that every ray may be excluded, for such is the sympathy between the organs, that when, in consequence of disease in the nervous apparatus, an eye has become quite insensible to light, its pupil, otherwise motionless, will contract whenever light is admitted to the sound eye. The hand may be used to momentarily exclude the light from the eye undergoing examination, the observer carefully watching any changes that may take place in the pupillary margin when light and shade are brought to bear upon the suspected organ. In doubtful cases a solution of atropine introduced between the lids would tend to settle the question. However, in the event of posterior synechia the pupil could not be dilated with a mydriatic.

Pain is not distinctive of iritis, nor is impairment of vision, for both may come from other morbid states. Purulent deposits upon the iris (hypopyon) give it the appearance of a gauze-like coating. The pus mixes with the aqueous, rendering it turbid, and gives it the appearance of whey.

The causes of iritis are numerous; among which are mechanical injuries (traumatic iritis). Clean cuts, as those made to establish artificial pupil, are rarely attended with

severe inflammation, while the lodgment of a foreign body in the substance of the iris, as a piece of steel or percussion cap, is always followed by destructive inflammatory action. Sometimes a splinter of steel or glass makes a wound in the cornea through which the iris protrudes; and if not returned the hernied mass becomes fast there. However, the protruding part may be snipped off with scissors, or be made to shrink under the touches of nitrate of silver. A metallic chip may lodge in the iris, and for a time appear to be encysted by becoming enveloped in lymph, but it is only temporarily encased and hid from view, for in time it will create iritis, and in the end destroy vision.

A forcible separation of the iris from the ciliary ligament is a serious accident which is often complicated with bleeding into the anterior chamber. Iritis follows, which has to be combatted with rest and endured with patience. In time the blood is absorbed, and a good degree of vision saved. A blow upon the eye may dislocate the lens and thus subject the iris to pressure. Iritis soon sets in, and lymph lodges in the pupil, blocking it up. In time the adjoining structures become inflamed, and vision is lost. To obviate such a result, the dislocated lens should be removed at once through an incision made in the cornea.

Inflammation of the iris, attended with neuralgia throughout the first division of the fifth pair of nerves, extending even to the second and third divisions, is, whether properly or not, termed *rheumatic* iritis. A severe attack is accompanied with lachrymation and intolerance of light. In its course it is attended with haziness of the cornea, and exudation into the area of the pupil. During the progress of the disease, if the cornea be not hazy, the veins of the iris can be traced on various parts of its surface, as delicate red lines, diverging from the edge of the pupil to the periphery of the iris.

A serious result of iritis is the exudation of lymph, which by organization unites the pupillary margin to the capsule of the lens (synechia posterior), the area of the pupil being encroached upon. In some instances iritis comes on slowly and almost imperceptibly, there being little pain, or outward sign of inflammation. Such an invasion may be termed

chronic iritis, yet its results may eventually prove as disastrous to vision as the acute form of the disease.

Treatment.—A patient just starting off with an attack of iritis, though not suffering severely, may turn prudence to a profitable account. Indoor rest with the eye shaded or bandaged, is necessary. Easy and reclining attitudes are to be commended. The diet should be nutritious, easily digested, and relishing, though neither hearty nor stimulating. The bowels should be kept open without cathartics. A two-grain pill of Chian turpentine may be administered every three hours every other day; on the alternate day a half-grain iodoform granule may be given every three hours. If there be considerable constitutional fever gelseminum or veratrum should be employed to reduce it or to hold it under restraint. During convalescence, iron, mineral acid, and quinine may be prescribed. The local treatment for iritis must be governed somewhat by circumstances. A dilute tincture of aconite may be applied to parts about the eye with advantage. It subdues circumorbital pains and checks nervous excitement. If a mydriatic effect be desired, and it often is when the pupil threatens closure, the tincture of belladonna may be combined with that of aconite.

Cold applications are not well endured, and often prove injurious. Hot fomentations, though generally dangerous to apply to the eye, may be risked in iritis, and rarely do harm, while in many instances they act like a charm. Leeches and blisters seldom do good, and usually inflict needless injuries. Steaming the eye over hot water is very agreeable whenever neuralgia is present. Irritating the skin about the eyes with chloroform does some good. Pustulation with croton oil has been commended. In a few instances I have relieved the pain attendant upon iritis by puncturing the cornea, and thus relieving the pressure upon the iris by taking out a few drops of the aqueous humor. The operation is not attended with pain or risk of any kind. A cataract needle or a slender knife is a proper instrument to make the puncture with. If the puncture be made near the margin of the cornea, no defect comes from the slight cicatrix following the tiny wound. A repetition of the puncture may be made every three or four days, or oftener, until the tension and neuralgia subside. Paracentesis is the remedy for hypopyon.

SYPHILITIC IRITIS.—Constitutional syphilis, in its evolutions, frequently inflames the iris. It produces the most marked kind of iritis, and is characterized by a tendency to rapid and abundant exudation on the iris, especially about the edge of the pupil, in which situation yellow, reddish-yellow, or nearly red nodules sometimes attain to such a size as almost to close up the pupillary area. The cornea may remain clear during an attack of syphilitic iritis, or it may show dots or minute vesicles of a pale buff tint, which appear like a cloudy haze.

A vascular zone in the sclerotic is observed just behind the corneal junction. The intolerance of light may not be as distressing as in rheumatic iritis, though as a distinctive sign it would not be sufficiently reliable to determine whether a syphilitic taint was present or not. In fact, there are no morbid symptoms in the iris which demonstrate whether they be syphilitic or not. If a papular eruption exist upon the skin, or ulcers of a suspicious nature exist in the throat, or other marked signs of syphilitic contamination be present, a coexistant iritis may safely be diagnosed as of the syphilitic variety.

Irides which have naturally a bluish tint, appear more or less green when invaded with syphilitic inflammation. This is caused by the presence of yellow albumen in the aqueous humor, the admixture of yellow and blue forming, of course, a green tint.

Syphilitic iritis may attack both eyes at once, but it commonly invades the right eye first, and the left sometime subsequently, or as a seemingly distinct invasion. In some instances a moderate degree of iritis in one eye might escape detection, unless it be determined by immobility or sluggishness of the pupil. In syphilitic iritis the danger is from closure of the pupil, which occurs by first having the pupillary margin unite with the capsule of the lens (*synechia posterior*), and then by the nodules of lymph extending over that part of the capsule covering the area of the pupil. Subsequent contractions draw together the pupillary aperture.

Choroiditis and retinitis may attend iritis, the inflammation extending by anatomical continuity or functional sympathy. True panophthalmitis and disorganization of the eye have followed a syphilitic attack of iritis.

Treatment.—Syphilitic iritis is not to be treated differently from ordinary iritis, except so far as the venereal taint is concerned. The local remedies are the same, as well as the diet. The eyes are to be shielded from light. Anti-syphilitic remedies are required to eliminate the venereal virus. What are anti-syphilitic remedies? Is mercury one of them? Very respectable authors allege that no agent is equal to mercury as a syphilitic expurgator; and others, just as experienced and respectable, declare that mercury is useless, or worse than useless. Dr. H. W. Williams, of Boston, an expert oculist, who has written "*A Practical Guide to the Study of the Diseases of the Eye*," says, "As regards the effect of mercury as a resolvent of effused lymph, I have seen so many cases where the pupil has become and remained obliterated by deposits, where mercury had been most lavishly, and, as it would be thought, judiciously administered; and, on the other hand, have so often seen the lymph absorbed, and the congestion of the iris resolved where only tonics had been given, that I can not coincide in a belief in the specific properties of this as surpassing those of any other remedy. A large proportion of the cases of both rheumatic and syphilitic iritis can be safely, quickly, and pleasantly relieved without it, and with a more rapid recovery of perfect health than where it is given. Many a case will perhaps be cited in the reader's mind, which *seemed* to go on more favorably, when, after a trial of other remedies, this was resorted to; but here the attack had already lasted a considerable time, and had probably reached its acme. As I have before stated, experience justifies us in believing, that from a certain point, varying in different cases, there is an evident tendency towards recovery, provided the deposit of adhesive lymph has not been so considerable as to fill the pupil and cement its edge to the surface of the lens. Given at this turning-point of the disease, when even an expectant treatment would have been followed by a favorable result, mercury has obtained credit which belonged to the *vis medicatrix naturæ*, or to other means employed conjointly with it."

I might quote other authors who use language more emphatic against the use of mercury in the treatment of syphilis and iritis, but quotations which express opinions contrary to partisan authority and a dogmatic adherence to

ancient notions, especially when the champions of a belief in the resolvent powers of mercury feel that interest is at stake, will not be potent to convince. The alleged specific qualities of mercury as anti-syphilitic, and the resolvent powers of the mineral in iritis and other diseases, have been questioned, and the defendants of the agent seem disposed to maintain their position, right or wrong. I do not propose to waste words in an attempt to convince those who are determined to continue in any given state of belief. Although I think that mercury is often prescribed when there is no rational indication for its use, yet, if I were to declare that the agent always worked mischief, and that no advantage could ever come from its employment, I might be classed as equally partisan with those who claim miraculously curative powers for the mineral.

A person having iritis, who is suffering from venereal contamination of a constitutional character, should take a variety of remedial agents of an alterative nature with the view of hastening the elimination of the virus. Any particular remedy should not be given more than a week at a time before it is changed for some other. The iodide of ammonium is an efficient alterative and anti-syphilitic. From three to five grains of this may be given in water, syrup, or other vehicle, four times a day. Cod liver oil is not well tolerated by the stomach, but it is a remedy of some alterative and resolvent power, and therefore may be tried until it disturbs the appetite and digestion, when it should be withdrawn. Sulphur often produces desirable effects. Veratrum should be given, especially when there is any vascular and nervous excitement. Muriated tincture of iron in five-drop doses contributes to a favorable result. Sarsaparilla, stillingia, and other vegetable alteratives exert some beneficial influence upon such patients as have been severely mercurialized. The bitter tonics as a whole do good by improving the general health. If the patient can be made to eat and digest well it does not make much difference what particular remedy is employed; and any course of medication which disgusts the patient and thereby reduces his strength and spirits, should be radically changed. A generous diet of a tempting nature frequently accomplishes more than medicine.

The local remedies for syphilitic iritis need not be different

from those already named in connection with common iritis. In all forms and kinds of iritis, the use of atropine as a mydriatic is not to be forgotten nor neglected.

Ophthalmologists are in the habit of devoting considerable space to the discussion of *scrofulous*, *gonorrhœal*, and *arthritic* iritis, calling attention to distinctions, though without establishing important differences. It would be unprofitable to draw attention to pathognomonic peculiarities, unless some advantage could be gained by a variation of treatment to suit the varieties of disease described. Iritis developed in a scrofulous patient does not necessarily require different treatment from that suggested for the common or syphilitic form of the disease. Iritis in a gonorrhœal patient would not improve any faster by the administration of copaiba and terebinthinate agents. Turpentine has a reputation for benefiting patients suffering from common iritis, therefore it might be useful in the management of a variety of the disease. Colchicum, which would be given in *gouty* iritis, might exert a favorable influence upon iritis in general. What is called the *arthritic* ring in the sclerotic is not peculiar to the gouty form of iritis, but to a peculiar anatomical blending of the cornea and sclerotic. Iritis, common or specific, is often complicated with morbid states which eventuate in staphyloma of the cornea and sclerotic, distortion of the dioptric media, and destruction of visual power. In such cases the iris may become adhered to the cornea, or protrude into a sclerotic staphyloma. But in these varied complications the iritis alone should not attract attention. A combined or compound morbid action is to be recognized and overcome.

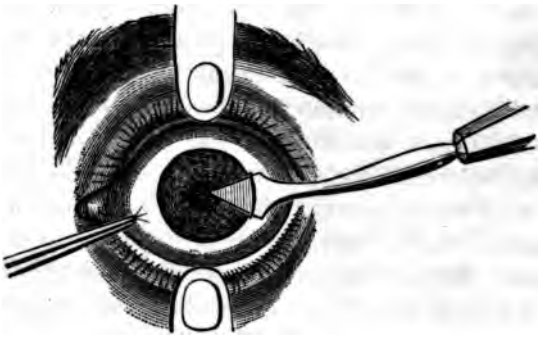
IRIDECTOMY.

The removal of a portion of the iris is executed for a variety of purposes: to open a new way for the rays to enter the eye when the pupil is closed; to enlarge a contracted or displaced pupil; to establish an artificial pupil behind a transparent part of the cornea when the central portion is rendered useless by a dense corneal opacity; to improve some forms of disease in corneal and scleral staphylomata; to diminish intraocular pressure as a relief for glaucoma; to enhance vision in lateral displacements and partial opacities of the lens and

capsule; to assist in various cataract operations; and to expedite the removal of foreign bodies embedded or entangled in the iris.

The instruments required to perform iridectomy are a straight and curved lance-shaped knife, a slender iris hook, and delicate and slightly curved forceps and scissors. Toothed forceps, to answer as an ophthalmostat, are needed when the eye rolls upward, to seize the conjunctiva below the cornea and fix the globe. The loose conjunctiva of old subjects is easily torn, therefore the teeth of the forceps should be long and sharp to reach the tendinous expansion of the muscles. Children and restless patients should be quieted by anæsthesia. One eye being closed with a protective bandage, an assistant holds the lids of the other eye open, and the patient occupies a recumbent position. The operation is divided into two quite different steps: the first embraces the corneal incision which

FIG. 35.



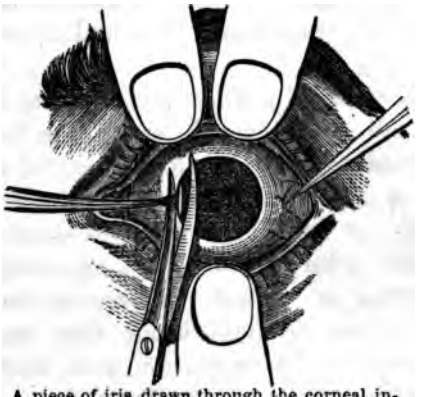
Incision being made in the cornea with a lance pointed instrument.

is from two to two and a half lines long; the second consists in drawing out and excising the piece of iris to be removed.

Stellwag says: "The incision in the cornea should always be made perpendicular to the meridian of the piece of iris to be cut out. Where the iridectomy aims at making a way for the rays of light, and where a somewhat central pupil may be made, the incision should fall a little outside of the middle of the corneal curvature. But where we are obliged to content ourselves with more of an eccentric pupil, it is best to make one incision a quarter of a line from the border of the cornea, in order that the remaining peripheral portion of the

iris may intercept the outermost peripheral rays. Where there is only a small space for the pupil on the corneal border, we should cut into the sclerotica about half a line from the margin of the cornea, and carry the knife in such a way that it enters the chamber exactly at the ciliary margin of the iris. The firm adherence to this rule is of the greatest importance in those cases in which the iridectomy is intended to influence in a remedial way the circulation and nutrition in the interior of the eye. If under such circumstances the incision is made within the corneal border, the operation is always fruitless. The knife should then be held obliquely when it is entered into the sclerotica. If, however, the incision is made in the cornea, the instrument should penetrate almost vertically through it, and as soon as it has entered the aqueous chamber it should be immediately turned, and its point pushed as far between the iris and the membrane of *Descemet* as the required length of the incision may demand." The knife should be withdrawn gradually to avoid a gush of the aqueous and a sudden relaxation of the globe, which might endanger intraocular hemorrhage.

FIG. 36.



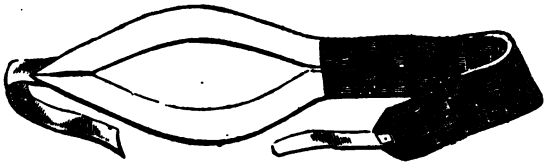
A piece of iris drawn through the corneal incision, is about to be excised with scissors.

"The second step in the operation always requires both hands of the operator. One hand uses the forceps, the other the scissors. The forceps should be held very lightly, and carefully placed in the corneal wound, with the convexity toward the globe, and carefully pushed forward to very near the pupillary margin of the piece of iris to be cut out. Then they are to be opened, just wide enough for the breadth intended of the artificial pupil. As soon as this portion of the iris near the pupillary margin is fairly and certainly seized, it is separated by delicate and gradual traction from any existing adhesions, and slowly drawn out with forceps. During this, the scissors are placed with the convexity of

their blades flat upon the globe, and as soon as a sufficiently large portion of the iris appears to be drawn forward, it is quickly cut off close to the edge of the corneal wound."

The dressing consists of a compress made of three layers of lint or jeweler's wadding, secured in place with a flannel bandage. The eye-bandage of Liebreich is a convenient holder of the compress. The part with the oval opening in it rests upon the back of the head, and the knitted belt

FIG. 37.



Eye-bandage.

covers the eyes. The bandage may be worn for a number of days, or until the wound in the cornea has healed, and active inflammation has subsided.

As a general thing a small artificial pupil is preferable to a large one; and especially if all the cornea in front of it be transparent. Should a corneal opacity be in the way of a direct transmission of light, a large aperture is often desirable.

A clear cornea, to get rid of dazzling sensations, should have the artificial pupil made upward; and central opacities call for excision of the interior and lower quadrant of the iris. If one operation does not accomplish all that can reasonably be expected, a second is in order, and with such modifications as the peculiarities of the case indicate.

To remove a piece of the iris including a foreign body, requires considerable tact. The incision with the lance-shaped knife is to be made in the cornea near its margin, the place selected being near the foreign body. That part of the iris embracing the extraneous substance is to be carefully grasped with forceps and deftly dragged through the wound, when excision with scissors is practicable. Such operations are frequently attended with considerable hemorrhage into the anterior chamber, yet disastrous results rarely follow this complication. The blood is in time decomposed and absorbed. The foreign body may be inclosed in a capsule of exuded

lymph, and remain undiscovered until the excised piece of iris is dissected. Sometimes, from intraocular pressure, the portion of iris enveloping the foreign body, will protrude through the wound in the cornea as soon as the incising knife is withdrawn. In such an event the prolapsed iris may be seized with forceps and excised. A delicate spatula readily returns any protruding portions of iris, and then the eye needs the after-treatment usually following iridectomy. The compress of lint may be changed every day, and the pressure of the retentive bandage regulated to suit conditions. If there be intraocular hemorrhage, a greater pressure is required than when this complication is absent. Children and intractable patients, who may push a bandage to one side, may have the lint compresses held in position with adhesive strips.

In the execution of iridectomy the lance-shaped knife is to be so directed in its course that the part of the iris to be seized can be grasped with the forceps or hook without rubbing the walls of the corneal wound, or rolling the thin and oblique edge outwards when the iris is being dragged through the wound. It will be perceived, upon considering the curves of the cornea, that if the blade of the knife enter the anterior chamber near the margin of the cornea, and be directed towards the ordinary place occupied by the pupil, the walls of the wound will be nearer perpendicular to the planes of the cornea, than a casual observer might suppose.

Whether a hook or forceps be used to seize the iris, care must be exercised not to injure the capsule of the lens, or cataract may follow the accident.

During the operation of dragging out the iris, it is perplexing to have this membrane tear. The lacerated wound will bleed, and the blood obscures the rest of the operation.

In cases of posterior synechia it is difficult to avoid injury to the capsule; and if the pupillary border is attached to the capsule, an intervening band of iris will remain between the real and artificial pupils. This may do no serious harm, yet it is generally best to break the bridge with a blunt hook, converting the two pupils into one. The remaining behind of the uveal layer of pigmentary matter—necessitated perhaps by posterior synechia—is a misfortune which may defeat the purposes of iridectomy, unless the obstruction can be

seized and removed at the time, or at a subsequent operation. Should a restive state of the patient during the progress of the operation result in a detachment of the iris from the ciliary ligament, the loosened part should be excised, even if the artificial pupil be unduly and unseemingly large.

Entire closure of the artificial pupil from inflammatory deposits, is possible; and in the event of its occurrence, a second operation may prove successful.

Detachment of the retina from the choroid, opacity of the lens, escape of the vitreous, and other accidents have accompanied and followed iridectomy, yet unfortunate results are uncommon.

As a rule it is not desirable to operate for artificial pupil when the other eye is perfect; and an active state of iritis should be regarded as a valid reason for deferring an operation. An iris thickened from chronic inflammation, or thinned from atrophy, is not a favorable one to attack. It may bleed too freely, or tear during attempts to bring it through the wound.

Some operators prefer to bring the iris out of a corneal incision with a delicate hook invented by Mr. Tyrrell. The objections to the method are that the hook is likely to tear the iris, and to catch the walls of the wound while being removed.

It is generally best to perform iridectomy without chloroform, though in some instances anæsthesia is indispensable. A spring speculum and fixation forceps are needed to hold open the lids and prevent the globe from rolling. The operation is not very painful, but the dread is great.

A sedative may be needed from time to time after an operation, especially at night, and the diet should be plain to avert a high grade of inflammatory fever. Mydriatics are to be employed during the process of reparation; and the forehead and parts about the traumatic eye bathed often with a tincture of aconite root. The bowels are to be moved every day or two with mild cathartics. A state of repose is to be enjoined; and a proper amount of sleep favored. Tinted glasses may be worn for awhile after the patient has begun to go out of doors.

CORELYSIS.—When the pupillary margin of the iris has become adherent to the capsule of the lens, the separation of

the adventitious attachments is sometimes practicable. Such an operation is called corelysis, and may be performed as follows: An incision is made in the cornea near its outer periphery with a lance-shaped knife; and through this wound a hook is carried, and made to break up the adhesions. The eye is prepared for the operation by the free use of mydriatics; and atropine should be used for several days after the operation. Fixation of the globe and anæsthesia are necessary to execute the manœuvre *tute et jucunde*. Great care is to be exercised in the manipulation of the hook, or the capsule will be injured. The after-treatment is like that of iridectomy, except in regard to the more frequent use of mydriatics.

IRIDODESIS.—The transformation of the pupil into an elongated slit, by securing a fold of the iris in a corneal wound by means of a ligature, is called iridodesis; and, according to Stellwag, may be performed as follows: "A fine silk or linen thread is introduced through the *limbus conjunctivalis* of the proper portion of the corneal margin, by means of a delicate curved needle. Its ends are for the time laid upon the forehead and cheek. Then an incision exactly as in iridectomy is made in the cornea, close to the conjunctival ridge. The thread is then made into a loop, and Fischer's forceps are introduced through this into the chamber. The iris is seized near the pupillary margin, and a portion of it is drawn out of the wound. The loop is then tied, and the prolapsed portion is then fixed. Of course, the ends of the thread are then cut off. The operation is best performed with the patient under the influence of an anæsthetic. The globe should always be fixed. One assistant holds one of the lids open, and with the other hand draws one end of the thread, when it is required to be tied. The operator, while holding the forceps with one hand holds the other lid with the ring and middle fingers of the other hand, at the same time drawing the thread with the index-finger and thumb of this same hand engaged in holding the second lid. A second assistant fixes the globe.

The after-treatment is like that of iridectomy. The loop generally falls off in about twenty-four hours; sometimes it remains, and should then be removed. The reaction is generally very slight, and causes no danger."

Iridodesis is performed to bring some portion of the pupil behind a transparent portion of cornea, to improve vision, though at a sacrifice of personal appearance. The same may be said in regard to iridectomy, unless the coloboma be made upwards, so the upper lid may hide the deformity.

THE LENS.

The crystalline lens is a double convex or disc-shaped body, about a third of an inch in its widest (transverse) diameter, and about a quarter of an inch in its antero-posterior diameter. Its anterior surface, which is the less convex, bulges into the pupil somewhat in front of the plane of the iris; and its posterior surface, which is the more convex, is embedded in a cup-like excavation of the vitreous humor. In early life the lens and its capsule are perfectly transparent; but at the age of thirty-five or forty, a period not unfrequently marked by a decline in the visual powers, it begins to take on a yellowish tinge which in old subjects attains an amber hue.

The lens is composed of a series of concentric layers enclosed in each other like an onion, a nucleus constituting the centre. The capsule, though exceedingly attenuated, is sufficiently dense and elastic to exert a compressing force upon the enclosed mass. The anterior half of the capsule is thicker than the posterior, and offers considerable resistance to blunt instruments, yet a rent started by a sharp instrument may voluntarily extend to the zonula, and allow the lens to escape. This hyaline envelop transmits nourishment to the lens from the aqueous and vitreous humors, the enclosed organ having neither blood vessels nor nerves.

The lens is held in place by the ciliary processes which form a peripheral clasp for its rounded border. These processes, sixty to eighty in number, and having pigment upon them, belong to the choroid, and serve to connect that membrane to the suspensory ligament of the lens. The ciliary ligament is a ring or band of fibrous material, whitish in color, which connects the peripheral border of the iris to the cornea, choroid and sclerotic, binding them all together, and giving attachment to the ciliary muscle which reaches from

it to the ligament of the lens and ciliary processes. The ciliary muscle is of unstriped fibre, consequently is not under the influence of the will. By the action of the muscle the lens is drawn forwards, so that the eye is adjusted to the viewing of near objects. The elasticity of the ciliary processes will return the lens to its normal position. It is possible that the lens is rendered more convex by the action of the ciliary muscle. If this be so, an increase in the accommodating power is obtained.

The function of the lens is to refract the rays of light which have passed through the pupil, converging them to an accurate focus at the surface of the retina. After the lens is removed in a cataract operation, a double convex glass is used in front of the eye to compensate for the loss of the refracting body.

CATARACT.

Cataract is a term used to denote a partial or complete opacity of the lens or its capsule. The opacity may depend upon faulty nutrition and atrophy, and upon inflammatory deposits among the layers of the lens. Not unfrequently fatty and earthy materials in the substance of the lens constitute the opacity. In some instances the cataractous changes proceed from the nucleus, though not so frequently as from the superficial layers of the lens. In rare instances a nuclear and cortical degeneration are observed at the same time. A cortical opacity has been termed *soft*, and a nuclear *hard*, though with not much regard for accuracy. A nuclear cataract is not always more dense than ordinary lens-tissue, nor is cortical cataract necessarily soft.

It is not uncommon for the outer layers of the lens to become opaque, and the capsule to participate in the changes, constituting capsulo-lenticular cataract. As a rule, however, the cataractous change is intracapsular, and affects only the lens-substance.

Congenital cataracts are frequently milky not only in hue but consistence. Those which form later in life may contain cholesterin "which glistens through the opaque capsule with a peculiar mother-of-pearl or silvery-like lustre," though the chief part of the capsular contents may be fatty and chalky.

Diagnosis.—The detection of cataract depends chiefly upon

a careful examination of the lens. The experienced observer sees the whitened lens at a glance. He recognizes at once the normal lustre and transparency of the cornea, and the tints of the iris. Looking through the pupillary aperture he discovers the hazy or cloudy lens, which seems to be in the way of that lustrous blackness usually observable beyond the pupil, in the deep cavity of the eye. An oblique or side view while peering into the eye, is often necessary while making an examination, as a reflected light from the retina may for a moment resemble the opacity of cataract.

Having made long journeys with the object of operating for the relief of cataract, and at my destination found nothing but a disorganized cornea, the physician calling me having made a mistake in the diagnosis, I hope I shall be excused for impressing what otherwise might seem an absurd point. If a physician can not distinguish between an opaque cornea and an opaque lens, he should not assume the responsibility of sending his patient to an oculist for an operation. If any practitioner entertains the preposterous notion that cataract is a "film" growing over the "sight" (cornea?), let him at once post himself in regard to the great anatomical divisions of the eye.

After the opacity has been examined casually, to determine that cataract exists, the pupil should be dilated in order to bring into view the greater part of the disordered lens. Shading the eye for a few minutes with the hand, will secure moderate dilatation of the pupil, but this is usually not sufficient. Two grains of the *neutral* sulphate of atropia to an ounce of distilled water constitute a good mydriatic. A few drops of the solution are to be let fall into the cup formed by drawing the lower lid away from the globe; then the lids are to be kept closed for fifteen or twenty minutes. The patient, after the pupil is fully dilated, should be placed to a window admitting bright daylight—not sunlight—and care should be taken that reflections from other windows, mirrors, and polished surfaces do not interfere with the inspection. A concave glass of an inch focus may be used as a condenser, to concentrate light upon the patient's lens, while it is explored with the naked eye. By this method of examination faint streaks of opacity may be detected, and a cortical or nuclear condition of the cataractous body determined.

With the aid of a pocket lens and oblique illumination the observer may recognize radiated striation, laminated opacity, cloudy or indistinct points, atrophy or decrease in the size of the crystalline, nuclear or cortical transformations, a tremulous iris, and other phenomena which go to make up the symptoms of cataract in its varied phases. If the iris at its pupillary margin be drawn backward and appear funnel-shaped, a shrunken cataract is logically presumed.

A partially cataractous lens absorbs and diffuses the rays of light, rendering vision more or less indistinct. The distorted curvatures of the lens refract irregularly, and disperse light. There are degrees of blindness produced by cataract, the visual disturbance depending much upon the condition of the lens. Persons with unripe nuclear or laminated cataracts make out large objects at a moderate distance quite well, and read large type, especially with suitably adjusted spectacles. Although patients affected with forming cataracts need the objects viewed to be placed in a good light, they are least annoyed, or most comfortable, in twilight and cloudy days. When the eyes are shaded, in nuclear cataract, the pupil dilates and lets the light through the pelucid periphery of the lens, rendering vision quite tolerable. But when the opacity has extended to the border of the lens, the cataract is ripe or complete, and the retina is shut off from the images of external objects. The wrinkling of the capsule in shrunken cataracts is a source of very decided visual disturbance.

During the formation of cataract it is not uncommon for material changes to take place in the deeper structures of the eye, such as attend retinitis, choroiditis, etc., establishing a state of affairs which exist in amaurosis. It is therefore necessary before operating in any case to ascertain if possible the condition of the retina, especially in regard to its sensitiveness to light. The amblyopia of monocular cataracts developed during childhood may come from disuse; and gradually pass off after an operation.

The sensitiveness of the visual nerves can not always be estimated by the movements of the pupil under the influence of light or mydriatics, for the pupillary margin of the iris may be fixed by posterior synechia. If amblyopia be complicated with cataract, the light of an ordinary lamp in a dark room can not be perceived at a distance of ten or fifteen

feet, as it may be in most cases of uncomplicated cataract. The functional activity of the retina and optic nerve can be tested with colored lights exposed at different distances. The range of the visual field is to be ascertained by moving a light at different distances before the eye, and questioning the patient in regard to the grade of impressions produced.

CONGENITAL CATARACT.—There are various degrees in congenital cataract, the slightest form being a white central spot or dot on the anterior face of the lens, just within the capsule. This defect is so unimportant that, if the rest of the lens remain transparent, this cataractous dot should not be subjected to an operation. Sometimes the central dot projects forwards, like an obtuse white cone, and seems to intrude upon the pupillary aperture, appearing to be capsular while in reality it is a part of the lens.

A common form of congenital cataract is where the nucleus is opaque, and around it is a transparent ring which admits the passage of more or less light, especially when the pupil is dilated. To an inexperienced observer this cataractous centre appears like a shrunken lens, and the dark surrounding to be the result of the contracting process. If not operated upon in childhood this ring-like peripheral border will at length become opaque.

A rarer form of cataractous defect is where the nucleus is not wholly opaque, but faintly striated. This condition may pass unobserved, until the patient, when sent to school, is found unable to read in ordinary type. Occasionally the defective vision will depend upon a dotting of the lens with minute white specks. Congenital cataract is generally accompanied by a rhythmical twitching and rolling of the eyeballs, (*nystagmus*), though defective sight from other causes than opacity of the lens may be attended with unsteady movements of the recti and obliqui muscles.

Scrofulous and carcinomatous deposits in the deeper structures of the eye have the semblance of cataract, though a careful examination will detect the real nature of the disease. In an eye affected with uncomplicated cataract the position of the iris is vertical, unless rendered funnel-shaped by posterior synechia; and the pupil is active. In the early stages of a scrofulous or encephaloid disease the opacity can be seen

behind the lens, though in time the lens may become involved, when for a season the diagnosis will be in doubt. In advanced stages of the scrofulous or encephaloid disorder, the iris is distorted, the pupil fixed, and the anterior chamber encroached upon. Congenital cataract almost invariably affects both eyes, while encephaloid disease as invariably finds lodgment in one eye. Congenital cataract is often associated with defective and crumbling teeth, which would lead to the supposition that the origin of the ocular defect is more constitutional than local.

A congenital cataract is commonly soft, even milky in consistence, hence it can not well be removed by the operation of "extraction," but is dissipated by incising the capsule with a needle, and trusting to absorption for the removal of the liquid lens.

A child blind with congenital cataract exhibits wonderful powers of feeling or palpation. The sense of touch is developed and educated to compensate for that of sight.

TRAUMATIC CATARACT.—A blow which ruptures the capsule, or a shock which disturbs the nutrition of the lens, is liable to be followed by cataract. A penetrating wound which reaches the capsule is about sure to induce opacity or destruction of the lens. If the aqueous humor come in contact with the lens through a rent in the capsule, it is apt to dissolve that body, so it may partly or wholly disappear. It was a knowledge of this fact that suggested the operation for the cure of cataract by *solution*. However, a wound of the capsule and partial absorption of the lens rarely result favorably. Some part of the lens remains, and becomes opaque from fatty degeneration. The capsule is thickened and distorted, the iris adheres to the disorganized lens and capsule, and the pupillary aperture is blocked up. Occasionally there is a deceptive appearance in regard to the pupillary opening. A patch of black pigment fixed in the whitish membrane which blocks up the pupil may appear to be a real aperture, and deceive the casual or inexperienced observer who very naturally supposes that considerable light may pass through the apparent opening. A pencil of light concentrated on the deceptive spot will dissipate any false impressions in regard to its character.

The shapes and states the capsule may take after it has been accidentally wounded have contributed not a little to a proper management of this membrane in operations for the cure of cataract. The capsule when wounded purposely, should be incised or lacerated in lines radiating from its centre, so that retractions towards the periphery may clear the axis of vision. An opaque portion which may block up the pupil, is a serious obstacle to vision.

Dislocation of the lens into the anterior chamber is an accident of a traumatic nature. The cut of a whip, a kick, sudden concussion, or any direct force applied to the eye, may dislocate the lens, and lodge it between the iris and the cornea. The iris then appears pressed back, and the pupil is immovably dilated. The lens, if transparent, appears more spherical than natural, and its margin presents a ring of golden light in contrast with a shadowy ring behind its free border. Pain and inflammation rapidly follow displacement of the lens, and loss of the eye can be averted only by prompt removal of the lens through a suitable opening made in the cornea.

A very severe force may tear the lens from its attachments and drive it into the vitreous body. Then active inflammation of the inner parts of the eye quickly occurs, and the functional power of the eye is lost by changes in the retina and choroid.

Rupture of the sclera may allow the lens to escape from its normal position and lodge beneath the conjunctiva. It is needless to say that the lens may be easily removed from this novel position, though the original injury may result disastrously to vision.

SENILE CATARACT, OR CATARACT IN ADVANCED LIFE.—Declining years favor the formation of cataract. Before the fiftieth year the eye resists opacity, but after that time, if the sight fail, cataract is to be suspected. The disease usually begins at the circumference of the lens, in the form of opaque striæ, which gradually advance along the anterior and posterior faces of the lens towards its axis. In rare instances the cataract commences in the nucleus, and slowly extends to the periphery, years being consumed in maturing the morbid changes.

Cataract appears first in one eye, and after developing there

to a certain extent, the morbid process begins in the other eye. The rise and progress of the disease are about as follows: first, opaque striæ appear at the extreme edge of the lens; these striæ gradually coalesce into patches and spread themselves over the entire lens, the posterior face being commonly invaded first. At this point of development the cataract may remain stationary for months and even years. Then what may be called a secondary metamorphosis takes place, and the whole body of the lens grows hazy, though the anterior surface may resist encroachment still longer. At length the entire lens becomes involved, and total blindness results. The striæ disappear from disintegration of the superficial fibres, and deposits of earthy and fatty materials impart to the lens a yellowish white appearance.

Occasionally a cataract forms without the opacity being white, say, of a dull brownish hue, and then the true nature of the difficulty is not so readily detected. An exceedingly rare form of lenticular opacity is that called "black cataract."

The *blackness* is not always demonstrated until the lens is extracted, though it may be observed as a dark opacity while in the eye. There is no danger of confounding it with the blackness of the pupil in a healthy eye, in which all the humors are perfectly clear.

Some cataracts are fluid from the beginning, or become so in the course of time. They usually present a bluish, milk-and-water hue, though a grayish, or pale yellow tint, like that of cream, has been observed. There is no propriety in calling them "Morgagnian cataracts," for there is no *liquor morgagni* in the human eye. Fluid cataracts are perhaps fuller than those which are hard, and therefore may press the iris slightly forward, but this sign can not be depended upon. The fluidity is often not suspected until an operation reveals the true condition. The alleged gravitation of the denser material to the bottom, and a floating of the lighter ones, can not be relied upon as signs of fluid cataract.

Treatment of Cataract.—Thus far therapeutic measures have proved impotent in the treatment of cataract. The vagrant oculist, who has not the skill and courage to perform an operation, occasionally imposes upon the credulous by employing atropia to dilate the pupil, thereby temporarily letting more light through the borders of a lens somewhat translucent at

the periphery, and by using a scientific-looking galvanic battery to divert attention from professional incapacity; but the accomplished eye surgeon never pretends by medical treatment to turn opaque lenses into clear ones. It is quite doubtful if any known agency will even stay the progress of a forming cataract. It is possible that preventive measures may avert cataract, for a time at least, in those predisposed to it. The abandonment of employments which require acute vision at short distances, such as, long-continued reading, writing, sewing, etc., and the wearing of broad-brimmed hats, eye-shades, etc., to keep off direct sun or artificial light, would certainly be rational.

All cataracts are not fit to be operated upon. As long as one eye is serviceable, an operation upon the other is, as a general rule, unadvisable. An unforeseen or unexpected accident may result in the loss of sight in both eyes. However, patients with monocular cataracts, after being informed of the dangers an operation portends to the sound eye, have demanded an operation to get rid of the cataractous deformity.

Old adhesions between the pupillary margin and the anterior capsule, a bulging forward of the lens and iris against the cornea, an irregularly dilated and fixed pupil, disorganization of the cornea, and total loss of power to perceive light, are among the more striking conditions which render it questionable whether an operation promises relief, or a result likely to be satisfactory. A patient with no other ocular defect than an opaque lens, can not only perceive the shadow of a passing hand, but with the back to a window can perceive the light reflected from a sheet of paper.

If, then, a patient have some perceptive power (which ensures a sound retina), an iris maintaining its vertical plane, a pupil round and active, a brilliant cornea, and an unimpaired motory apparatus of the eye, the cataract is logically suitable for operative treatment. The freedom of the iris from concealed attachments to the capsule, can be tested with atropia. An eye which has passed through inflammatory attacks and is therefore unfit for operative interference, can be recognized by a variety of peculiarities not easily described. The propriety of operating in some cases is determined more by empirical impressions than by written rules.

It is a question among ophthalmic surgeons, whether in

binocular cataract both eyes should be operated upon at one sitting. If every condition is favorable there is no valid objection to the double operation; but in many cases there will exist some modifying circumstance which must exert its influence. Not unfrequently considerable visual power still resides in one eye, therefore the degree of functional impairment must be considered. Although partial corneal opacities and pupillary attachments do not necessarily forbid a double operation, they constitute conditions which ought not to be overlooked. If one eye can probably be saved if operated upon alone, and a double operation would endanger both through sympathy or excess of inflammation, the single operation alone is indicated.

Patients affected with gout, syphilis, habitual headaches, neuralgias, and severe nasal catarrhs, are uninviting subjects for cataract operations.

The age of a patient is not a serious obstacle to operative interference. Infants may be operated upon for the relief of congenital cataracts, and the aged may endure an operation well.

Patients with favorable surroundings may undergo an operation at any time of year, though extremes of heat and cold should be avoided.

An operation having been decided upon, the choice of methods for each particular case is to be made. The procedure which promises to remove the cataract from the axis of vision with the greatest ease and least danger, is to be adopted.

Fluid and pulpy cataracts, without hard centres, may be gotten rid of by *solution* (*division* or *discission—needle operations.*) The edges of the incised or lacerated capsule will retract, and let the aqueous humor in contact with the opaque lens. The iris is to be kept away from the capsule by the prolonged use of mydriatics. Congenital cataracts are apt to be fluid, and are therefore fittest for a needle operation. In many instances the operation has to be repeated from time to time to bring the aqueous humor in contact with parts of the lens which are hard, or have been protected by uncut or untorn portions of the capsule.

As the operation by discission is a very unsatisfactory one, it is now considered best to remove even fluid cataracts through a linear corneal wound, a delicate spoon being used

to scoop out any fragments which may remain within the capsule.

The dangers of a corneal wound consist in prolapse of the iris, and the loss of more or less of the vitreous in unruly patients. Anæsthesia subdues the patient during the operation, yet the nausea and vomiting which frequently follow endanger secondary prolapse of the iris and vitreous.

The ripe and firm cataracts of adults are to be removed by extraction through wounds made in the cornea or sclera, with or without iridectomy. As a variety of methods are in reputable use, it will require considerable space to describe them.

CATARACT OPERATIONS.—There are three general terms used to express the methods which have a history in operations for cataract, viz: *depression*, *solution* and *extraction*.

The lodging of the opaque lens in the vitreous humor, below the axis of vision, is an obsolescent operation which bears the name of *depression*. When this operation was the only one known for the treatment of cataract it was considered a triumph of surgical skill. So instantaneous the benefit conferred, and so trifling the pain inflicted, that it is not altogether strange the operation seemed to the inexperienced as a fine piece of jugglery. The operation was performed as follows: The needle was introduced through the sclera about a line from the border of the cornea, a little above or below the equator, and was carried between the iris and the lens until the point could be seen through the pupil, and then the flattened needle-point was made to push the lens backwards and downwards until it disappeared in the vitreous below the axis of vision. The best operators were careful not to force the lens upon the retina or ciliary processes. The position of the lens appears

FIG. 38.

One method of performing a "needle operation."

very neat in the diagrams made to represent where it should rest, but there is no assurance or probability that the displaced lens would stay where it was thrust, even if fortunately placed. Certain it is that the displaced lens very frequently excited a destructive inflammation by pressure upon the retina, ciliary processes or iris. In some instances the depressed lens would rise to its original position and re-obstruct the passage of light to the retina.

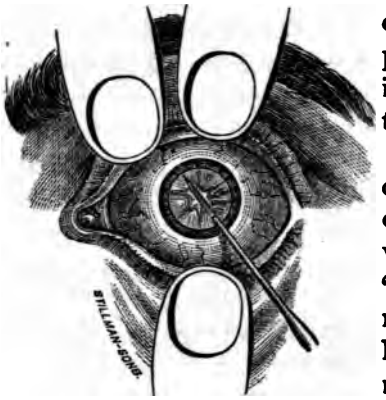
RECLINATION.—To avoid the difficulties following depression, an attempt was made to improve the operation by reclination, as it was called, the lens, instead of being forced directly downwards, was pressed downwards, backwards, and a little outwards, its anterior surface facing upwards. If the opaque lens proved too soft for couching, the needle-point would lacerate the capsule, thereby allowing the aqueous humor to effect solution.

Other operators, finding that the elasticity of the healthy vitreous humor was an obstacle to the passage of the lens through it, suggested that the needle should first be passed to the spot where the lens was finally to be lodged, and that a bed should there be prepared for it by the disintegration and breaking-up of the cells of the vitreous humor; and to this bed (couch) the lens was finally to be conducted by the needle applied to its anterior surface. This was very ingenious in theory, but practically no superiority was gained over depression or reclination. The patient may have been delighted because temporary sight was restored, but disappointment followed as soon as inflammation set in.

OPERATION BY SOLUTION OR ABSORPTION.—In this operation, which is a modification of that by depression and reclination, it is proposed to break up the lens, and hope for its disappearance by *solution*, the aqueous humor exerting the dissolving influence. It was once supposed that the more completely the lens was broken up at first, the quicker and the more thoroughly would absorption go on; therefore the term *discission* was applied to the cutting-up operation. It is now known that the dissolving method is progressive, that is, it should be accomplished at several sittings. At first the capsule is to be lacerated, then after a few weeks have elapsed,

the lens is to be punctured or incised, and finally undissolved parts of the lens are to be attacked. However, the process is so tedious and wearisome, the more rapid cure by extraction is to be preferred. The operation by "division" is best adapted to the soft or liquid cataracts of childhood; and the needle better be carried through the cornea than the sclera, the point of entrance being selected away from the axis of vision. In cases of congenital cataract the operation may be performed upon a child before it has arrived at the age of teething.

FIG. 39.



Needle operation made through the cornea.

Different operators prefer different shaped needles. The escape of the aqueous is prevented by what is called a "stop-needle," the shaft being made conical to stop the corneal hole the point (a slender one, not lance-shaped) has made; but the wedging of the shaft is an obstacle to the free movements of the needle's point. Not much of the aqueous is lost, even if a lance-shaped point be used, the shaft being constructed in such proportions to the size of the opening as to fill it without moving under restraint. Some operators prefer a needle with a curved point and a cutting edge, especially for dividing the posterior wall of the capsule after the lens has been absorbed.

All cataract operations are best performed with the patient lying down, the head being slightly elevated, and the couch so arranged in regard to a window as to secure a strong light. An assistant steadies the head of the patient, and with his fingers holds apart the lids, unless they be fixed with a spring speculum. Timid and refractory patients are difficult to govern, therefore the operator may have to steady the eye with forceps which are made to nip a fold of the conjunctiva just beneath the cornea. Toothed forceps should be at hand, which can be made to fix upon the sclera in the event the conjunctiva prove thin and easily torn. *Keratonyxis*—operation

through the cornea, is preferable to *scleroticonyxis*, or puncture through the sclera. In the former operation the point of the instrument is always kept in view; and the scar left in the cornea is insignificant. The needle is made to enter the anterior chamber perpendicularly to the plane of the cornea, after the pupil has been well dilated with mydriatics, and then the point of the instrument is carried directly to the centre of the anterior wall of the capsule, when this membrane is to be lacerated in various directions, and the body of the lens pierced so as to cut the posterior capsular wall. Congenital cataracts permit of more discission than those of adults. The liquid cataracts of infants will frequently spurt their contents into the anterior chamber as soon as the capsule is slit with a needle, the contents of the lens being like whey and granules of curd. The heavier portions gravitate to the bottom of the chambers, and would seemingly excite destructive inflammation, though such in fact is not usually the result.

In an infant with congenital cataract, both eyes may be operated upon at once; but in an adult, with one cataract more ripe than the other, the riper should be operated on at one time, and the other eye left for another occasion. The patient is thus left with one partially useful eye, while the process of solution in the other is going on.

After an operation both eyes should be kept closed by means of a light bandage, or strips of plaster; and the patient managed in every respect so as to avert inflammation. In a week or two it can be seen what the operation and its sequences have effected. It is well to keep the pupil dilated for a few days following the operation; and to administer a cathartic a day or two before the operation. It is not necessary to employ an anæsthetic, unless the patient be extremely refractory. A child can be well wrapped in a shawl, and then held without much difficulty. Sometimes the parents presuming the pain is greater than it really is, *demand* that an anæsthetic be administered.

If the lens, when attacked with the needle, is found to be hard or of firm consistence, the capsule may be torn and the lens moderately incised, though in adults care should be exercised not to set free any considerable pieces, lest they excite dangerous inflammation. It is well to extract a lens at once,

after it is found to be hard. If a repeated needle operation be tried, there is no unvarying period that must intervene between repetitions. In children it may be best to wait months to ascertain what the absorptive processes may accomplish. In an adult a few weeks may elapse between operations.

It is not unfrequent for nausea to follow a needle operation, especially if a detached portion of the lens rest against the iris; and attacks of neuralgia afflict patients predisposed to nervous disorders. The nausea may be combatted, when prolonged, by swallowing bits of ice, and the neuralgia may be subdued by the use of aconite and chloroform liniments around the eyes.

OPERATION BY EXTRACTION—*Flap Operation.*—The solution and absorption of a cataract in adults constitute so slow and unsatisfactory a process, that the more rapid method by *extraction* was devised. This mode consists in removing the lens at once through an incision made in the cornea or sclera.

There are several ways of executing extraction, which to be learned must be studied separately. I will describe first what is called the flap operation. This was an invention of Beer, and the knife devised for making the corneal section still bears his name.

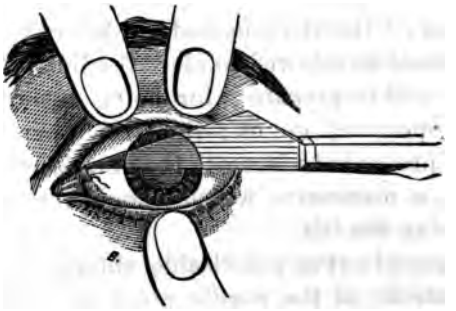
The introduction of better operative methods and means, was followed by as great improvements in therapeutic management before and after the operation. Mr. Dixon, a distinguished English ophthalmologist says, in referring to the course pursued by the older oculists: "The astounding plan of after-treatment which so long prevailed, and the remains of which still linger among us, makes us wonder, not that so many eyes were formerly lost after extraction, but that any were saved. Low diet, carried to the verge of starvation—profuse bleeding, both general and local—active purging and mercurialization, and long confinement to dark rooms—formed a course of discipline by which surgeons hoped to heal a wound inflicted on a structure devoid of blood vessels, and peculiarly liable, therefore, to slough or ulcerate whenever its vitality was lowered by any exhausting agencies. These surgeons saw the cornea die in persons worn out with scarlet fever, erysipelas, small pox or typhus; and yet, in the after-

treatment of extraction, they seemed bent upon reducing the patient as near as possible to the same condition as those diseases would have done."

Although the flap operation as once performed is almost wholly superceded by "linear" or "modified linear extraction," there are cases in which it may still be performed with as much success as some of the later "approved" methods. The objections to it are that the thin edge of the flap will not heal as readily as the perpendicular walls of a "linear" cut; and that the hard cataracts of advanced life can not be readily delivered through the pupil and the corneal wound. Or, if the delivery be accomplished a spoon can not be easily used to scoop out the portions left behind.

The flap operation was formerly made downward, but the objection being raised that the edge of the lower lid interfered with the wound, a change was instituted to a section upward. The operation is made as follows: after the pupil

FIG. 40.



Flap operation; Beer's knife making a section of the cornea.

has been dilated the operator, leaning over the recumbent patient, enters the triangular knife of Beer on the temporal side of the cornea, carries it across the anterior chamber and through the cornea on the nasal side, and then far enough in the same general course for the apex of the blade to complete the section. The flap thus made constitutes more than one-third of the cornea; and though the incison is made close to the corneo-scleral junction, both edges of the wound are wholly of corneal tissue. The point of the knife enters the anterior chamber perpendicularly to the plane of the arched

cornea, so as not to split the layers of that structure, then as soon as the point of the instrument is seen, the knife is turned so as to pursue a course parallel to the plane of the iris. The counter-puncture is made on the same level with that of entrance. The knife has to pass through a chamber filled with fluid, and the escape of even a few drops would invite the elasticity of the eyeball to force the iris against the edge of the instrument, therefore the blade regularly increases in width and thickness from the point to the widest cutting part. Such an instrument, if steadily carried in one direction, without rotation, completes the wound at a single thrust, while its wedge-like form prevents the premature escape of the aqueous humor, and so lessens the danger of wounding the iris.

An assistant raises the upper lid of the eye to be operated upon and the operator manages the lower while operating upon the left eye, the duties of managing the lids being reversed while operating upon the right eye. Forceps may be used to fix an unsteady eye, though little movement is left to the patient after the knife enters the cornea. As soon as the section is made great care must be exercised not to press out any portion of the vitreous body. After the flap is made, the patient should be allowed to close the lids for a minute to rest the organ and to prepare it for being steady while other parts of the operation go on; then the operator lifts the upper lid and proceeds to lacerate the anterior capsule with a curved needle, a manœuvre which should be accomplished without touching the iris.

As near a crucial cut as practicable should be made in the capsule, each stroke of the needle point reaching across the area of the pupil. The laceration of the capsule requires a careful use of the needle; and when once executed the instrument is to be withdrawn without entangling the iris, and the last act of the operation—the removal of the lens—performed. The lacerating needle (cystotome) is usually mounted in the same handle with Daviels's scoop or small spoon (curette), and with this placed upon the eye above the wound in the cornea, and the finger against the globe below, gentle pressure is made alternately by force imparted to the instrument and finger, which makes the lens turn on its transverse axis, the upper edge becoming tilted a little forwards, as it is inclined to do. As the lens revolves its upper edge engages

in the pupil and readily glides into the wound, when, if the pressure on the globe be not moderated the delivery will be too rapid, endangering a gush of the vitreous. If the wound and pupil be large, and the lens small, the delivery will be easy and free; while if the wound be small, and the lens bulky and softened on its surface, a considerable quantity of lens matter will remain in the pupil and about the lips of the wound.

The ready union of the corneal wound, upon which much of success depends, is favored by clearing away all soft lens matter which may adhere to the angles of the incision. The iris, which frequently protrudes, must be carefully returned with a small spatula. The emptying of the capsule being as complete as possible without thrusting in the spoon too often, an upward stroke of the scoop will adjust the corneal flap and bring the lips of the wound into apposition. The upper lid is then to be brought down by lifting it over the wound by the eye-lashes, so as to prevent the edge of the tarsus from catching against the projecting flap of cornea. The lids are then to be closed with strips of adhesive plaster or light compresses and a bandage. The loss of any of the vitreous humor is to be deplored, though the eye is not necessarily ruined.

After the operation is completed there are several dangers to be apprehended. There may be hemorrhage, which occasionally sets in several hours after the operation. The danger is not from loss of blood, but from its presence among the humors, the effects of which are disastrous to vision. The corneal flap may slough, as another danger; the iris get into the wound as another; and destructive inflammation may follow a well executed operation.

The wound in the cornea, under favorable circumstances, heals rapidly. Usually sufficient adhesion occurs in a few hours to retain the re-secreted aqueous, which soon restores the iris to its normal position. However, it requires several days for the healing process to make the union firm enough to withstand the intra-ocular pressure. During this time soft compresses of folded linen are held gently upon both eyes with a flannel or elastic bandage. It does no good to be peeping in to see what is going on.

As soon as the operation is completed, including the dress-

ing, it is well to administer to the patient a dose of chloral or morphia. This will allay the pain if it has come on, or prevent it if not already set in. A repetition of the anodyne doses is to be governed by the pain. No more anodynes should be administered than the necessities of the case demand.

It ought to have been mentioned that the bowels should be freely moved the day preceding the operation, and then a cathartic need not be employed for several days. The diet for a few days after the operation may be light yet nutritious and easily digested. If the appetite be poor it may be encouraged with acids and bitter tonics. Stimulants should be avoided unless the patient has been accustomed to them, where total abstinence would be worse than moderate indulgence.

The progress of the healing process is to be judged by the fluids escaping and by the appearance of the upper lid. If the discharge from the palpebral fissure be mostly tears and conjunctival mucus, and the upper lid be natural in hue and general appearance, the probabilities are that a satisfactory union is going on.

An unfavorable sign after a season of restlessness is redness and swelling of the upper lid two or three days after the operation, attended with a puriform discharge from the palpebral sinuses. When the lid is raised, if the ocular conjunctiva be found injected and swelled (chemosis), the condition is not good. If the cornea is throughout yellow and opaque, and the wound is filled with bulging irides, vision is lost. The flap sloughs in such cases, the eyeball shrinks, and sight is irrevocably gone. This unfortunate state of things is not always the fault of the operator. It may arise from defects peculiar to age, from cardiac troubles, and from fatty degeneration.

If everything goes on favorably for four or five days after the operation, a successful result may reasonably be expected, though the eye should be kept in a bandage dressing for three or four days longer, and strong light is to be avoided for a week or more. During the period of convalescence gelseminum, hyosciamus, or kindred agents may be given at night, and bitter tonics in the daytime.

A prolapse of the iris along the track of the corneal wound may not remain a permanent source of annoyance. A vesicular projection may be snipped off with scissors, when

the cut surface blends with cicatricial corneal tissue, and is no longer troublesome. A delicate fistulous opening near a piece of prolapsed iris may drain away the aqueous fluid as fast as it is secreted, and become exhaustive in the end.

Dr. J. R. Wolfe, Lecturer on Ophthalmic Surgery in the Aberdeen Medical School, has written a small work on "An Improved Method of Extraction of Cataract," in which the author claims an easy exit for the entire lens, without loss of the vitreous, by performing iridectomy several weeks before the operation for extracting the lens is attempted. His object is to prepare in advance a large opening in the iris for the escape of the entire lens, without incurring a loss of the vitreous. After the iridectomy is executed, and the eye has fully recovered from the operation, a wound is made in the cornea with a knife much like Beer's, the section being essentially that of the ordinary "flap operation." In traumatic cataract with dislocated lens, Wolfe performs iridectomy and extraction in one operation, the patient being under chloroform; but in all other cataracts he performs iridectomy, and, then, in about six weeks, extracts the lens through a corneal incision. He says: "I rather avoid doing both operations at the same time, because in some cases iridectomy can not be satisfactorily performed with a large opening—the corners of the section in the iris are apt to be invaginated in the corneal wound, thus giving rise to a larger pupil than the operator intended, which interferes subsequently with distinctness of vision—because the fresh wound of the iris may be irritated by the *debris* of the lens; because the blood from the iris may conceal the lens from view, and so render its removal a sort of groping in the dark; and, finally, because when there is a glaucomatous tendency, or softening of the vitreous, the simultaneous performance of the two operations may cause internal hæmorrhage or collapse of the eye.

"As a rule, then, the eye can more easily bear the operation when thus divided into two periods, and the different stages of the operation can be performed with more regularity and precision.

"In old people I perform iridectomy and the subsequent flap downwards, and find the optical effects perfectly satisfactory; and in middle aged persons, where regard must be had to appearances, I make them upwards. In either case I

perform iridectomy exactly in the vertical meridian of the eye, so that the coloboma iridis shall correspond with the centre of the subsequent corneal section. The extraction is done as follows:

"The patient being in a recumbent position upon a high couch, and the eyelids being held aside by an assistant, I stand behind the patient, operating with the right hand on the left eye and with the left hand on the right eye.

FIG. 41.

Wolfe's section of the cornea, iridectomy having been performed a few weeks previously.

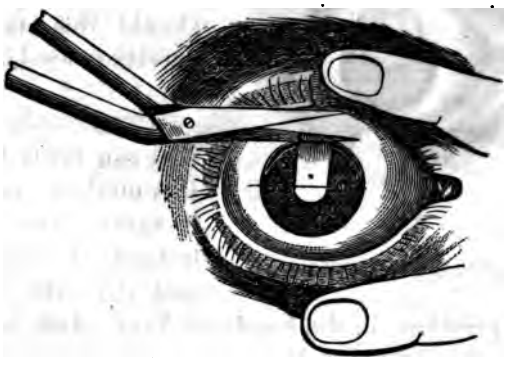
"1. With the right hand I fix the globe with a pique de Pomaud, which I consider the most suitable instrument; with the narrow Beer's knife in my right, I enter the external margin of the cornea close to its sclerotic junction, perpendicular to the surface, as if wishing to reach the iris, in order to prevent the knife running between the layers of the cornea, and also in a downward direction, after Graefe's example, in order to enlarge the internal opening. After the point is seen in the anterior chamber, I carry the handle backwards and pass to the counter-puncture, which is made directly opposite on the inner side. The points of puncture and counter-puncture are so made that the corneal flap extends to a line more than one-third of its circumference. The knife is then pushed on in a plane parallel to the iris, until the corneal section is nearly completed, when its edge is inclined a little backward, so as to carry it under the conjunctiva, and it is then withdrawn, leaving a conjunctival bridge in the centre.

"At this stage I take entire charge of the eye. My two

fingers of the left hand serving the purpose of a speculum, I order the patient to look down, and introduce one blade of the probe-pointed scissors in the track of the knife, and, carrying it to the conjunctival flap, divide it. When operating on the left eye I must here change my position, as the scissors can not conveniently be used with the left hand, and it is not advisable to divide the conjunctiva with the knife, as it is apt to peel off.

"The capsule is then largely opened with the cystotome. To facilitate this process, gentle pressure with my fingers upon the ball is necessary to make the capsule tense.

FIG. 42.



Wolfe's section of the conjunctival flap with scissors.

"After a few seconds' rest, I seize a fold of the upper eyelid between my fingers, and the lower I depress with the other thumb, and, directing the patient to look down, I exercise pressure on the lower part, exactly in the vertical meridian facing the middle of the coloboma iridis, and with the other fingers through the eyelid I press upon the wound to make it gap, when the cataract advances through the corneal and conjunctival flap.

"Due attention must be paid to this direction; pressure must be made at the point just indicated, otherwise the lens is pushed sidewise, and may rupture the hyaloid or damage the ciliary processes. This is, indeed, the most critical stage of the operation, for the surgeon must have his art literally at his fingers' ends. If inordinate pressure is used, the vitreous may come out, and the lens fall backwards. The pressure must be steady and graduated, and with due co-

operation of both hands. If the cataract be found adherent (which can easily be diagnosed beforehand), I introduce the hook in the same manner as I introduce the cystotome, first in a horizontal direction; with it I lacerate again the anterior capsule, to make sure that there is no impediment from that source; then I slip it flatly behind the lens, turn the point forwards, and draw the lens out. If cortical fragments remain behind, the ordinary friction and sliding manœuvre, as adopted in Graefe's operation, is used to extrude them; should this fail a small curette is used."

FIG. 43.

The escape of the lens in Wolfe's operation.

* * * *

"The only objection that can fairly be made to this method—namely, that it makes two operations instead of one—may be met by the fact that Graefe's operation, in the hands of Prof. Arlt, has required subsequent operation in ten per cent. Of these secondary operations, according to Wecker, only fifty per cent. recover sight; if, therefore, two operations are to be performed, it is infinitely preferable that the secondary one should precede, and not follow, extraction. Besides which, it is frequently of essential importance to become acquainted with the habit of the patient's system, which we do during the previous iridectomy."

LINEAR EXTRACTION. — The operation of breaking-up soft cataracts with a needle, and subsequently evacuating the pulpy mass through a small incision in the cornea, is called "linear extraction." The term is not well chosen, for it fails to accurately convey the intended meaning, namely, that the corneal wound is made in a *straight* line, in contradistinction to the *crescentic* wound made in ordinary extraction. "Rectilinear" would be the correct term, as implying that the wound is to be made straight.

After the pupil is fully dilated with atropia, the cornea is to be incised to the extent of two or three lines with a lance-shaped knife. The incision is always to be made on the temporal side of the cornea, in the horizontal meridian or somewhat below it, about one line from the scleral border. The knife should be so placed that its cutting edge shall stand perpendicularly to the meridian of the point of entrance, and pass obliquely through the cornea, and towards the pupil. The depth of the wound should be sufficient to make a corneal section of two lines or more in length, the knife being lance-shaped the incision in the outer layer of the cornea will be longer than in the inner layer. The knife is slowly withdrawn, and the aqueous humor escapes.

If the cataract be fluid or pulpy, and the capsule clear, a sickle-shaped needle is passed through the wound flat-wise, and the capsule is then divided with long strokes in various directions. Fluid cataracts will be evacuated, for the most part, during this manipulation; and some portion of pulpy lens matter will escape. To complete the evacuation, the convex surface of Daviel's spoon is pressed against the outer lip of the corneal wound to make it gape. Then, by gentle pressure on the inner portion of the globe, the cataract is forced towards, and into, the gaping wound, and escapes. If any fragments of the lens remain behind, the lids may be closed for a few minutes to allow some aqueous fluid to collect, after which another attempt may be made to favor their escape. If pulpy lens matter still refuse to come out, the scoop may be introduced through the wound and be made to complete the evacuation, though the passing in and out of instruments through the small corneal wound is to be avoided as much as possible.

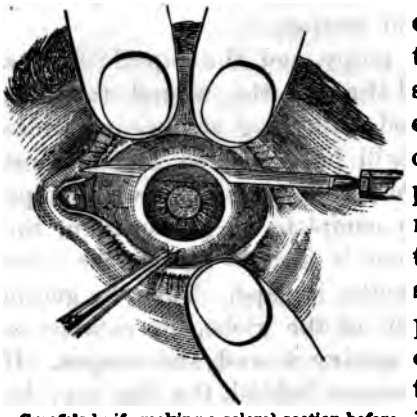
Should the cataract prove to be hard, an iris-hook is to be introduced flat-wise through the wound, the capsule seized, and then dragged towards the point of exit. If the hook tears out, and the edge of the cataract can be grasped with forceps, the instrument is the best from its having more points for attachment.

If a portion of iris prolapse and it can not be successfully returned by the aid of the spoon and shutting of the lids, the prolapsed portion should be seized with forceps, and with scissors cut off close to the cornea.

After the operation is completed the lids should be closed with strips of adhesive plaster or a protective bandage. A solution of atropia used about the lids favors the return of a prolapsed iris.

MODIFIED LINEAR EXTRACTION.—To remove firm cataracts and escape suppuration of the cornea, the late Professor Von Graefe, of Berlin, proposed to extract the lens through a scleral wound, after performing iridectomy. This method the distinguished operator called "Modified Linear Extraction."

FIG. 44.



Graefe's knife making a scleral section before performing iridectomy and extracting the lens.

A long slender knife is employed to make the section in the conjunctiva and sclerotic; and the knife is entered quite close to the corneal border on the temporal side, the cut being made upwards. Although the incision is made in the scleral structure, the knife passes through the anterior chamber, *i. e.*, in front of the iris, the patient being in a recumbent position, and the eyelids separated by a speculum or assistant. The operator stands at the side of the patient when operating on the left eye, and behind him when on the right. To prevent rolling of the globe the operator with his left hand seizes the conjunctiva with toothed forceps just below the cornea, and steadily draws downwards. If the conjunctiva be loose, thin, and easily torn as it often is in old people, the teeth of the forceps should be sharp and long enough to grasp the sclerotic.

The operator enters the point of the knife a third or half a line from the cornea, and when carried straight through to complete the section, about one quarter of the circumference of the globe at that point is incised. But the knife is made to enter the anterior chamber as if to reach the centre of the pupil, and then it is turned horizontally, so as to be passed through the corresponding inner portion of the anterior

scleral zone at the same height, and at an equal distance from the cornea as the point of entrance. After both conjunctival and scleral walls are transfixed with the knife, two or three sawing motions are imparted to the knife, by which the sclerotic is completely incised. A fold of conjunctiva which is distensible and loosely attached, is raised and should be cut by turning the edge of the knife forwards to the corneal attachment where it may be incised without danger of peeling the membrane from the sclerotic. The oblique entrance of the knife to the anterior chamber, is to enlarge the internal opening, and to avoid the small shelf or corner at the commencement of the wound, which is necessarily left when the knife is carried throughout in a horizontal direction, and which presents an obstacle to the passage of the lens.

The conjunctival and scleral section having been completed, the iris is seized with a pair of forceps, pulled out, and with scissors cut off close to the incised sclerotic, so that no tags may remain in the wound. While the operator is performing this, the second step in the operation, the assistant takes charge of the fixation forceps.

If a speculum has been used it may now be dispensed with, and the operator re-takes the fixation forceps, and with a sickle-shaped needle passed flat-wise through the wound as far as the lower part of the pupillary border, and then turned towards the lens, he incises the capsule in various directions. If the capsule be well incised, the lens often appears at the scleral opening, and but little assistance is required for its escape. If the lens do not move from its bed, the back of a scoop may be pressed gently upon the lower margin of the cornea, and then gradually slid upward, while no counter-pressure is applied to the upper part. When the cataract is advancing, the back of the spoon is pressed more strongly upward, until it has reached the centre of the cornea, thus chasing the cataract towards and through the wound. If the lens lodges in the lips of the wound, it may be removed with a hook or spoon.

If the described manœuvres do not dislodge the lens it may be seized with a hook or traction instruments and dragged out. The hook cuts through a normally consistent cataract; and in such an event the spoon should be used to remove the fragments.

When cortical masses remain behind, as happens in the majority of cases, the lids may be allowed to close for a few minutes until some aqueous humor is collected, when the *debris* is driven towards the wound by circular friction through the closed eyelids; then, after opening the lids, the fragments are removed by gentle sliding pressure, or, if this be inefficient, by means of a small spoon introduced into the anterior chamber.

It should be esteemed important to clear out the cataractous lens as completely as possible; to draw out portions of capsule that obstruct the axis of vision; clean the wound properly, and remove any pieces of iris that may be caught in it; and, finally, to replace the conjunctival flap in its natural position. When all this has been done, and the eye has been closed, it seems advisable to open the eye again, to see if everything appear in good condition. The re-opening of the lids assists to wash out small pieces of cataract and effused blood.

The operation having been completed, the lids are to be closed with a soft, elastic bandage, and kept so for a couple of days. After that time the dressing may be removed twice daily, and a solution of atropia instilled between the lids.

Chloroform should not be employed in the operation, except to very timid and unsteady patients, for the after-sickness is liable to force open the wound and to empty the eye of more or less of its contents.

The principal danger in the operation is the loss of the vitreous. The accident may happen immediately after the section, by the incision being carried so far back that the zonula is left unsupported, and so may arch forward and burst; or by the point of the scissors touching the zonula in excising the iris; or by strong backward pressure of the needle or cystotome upon the hard cataract; or by too firm pressure in attempting to expel the lens; or by spasm of the orbicularis; or, finally, by a pre-existing diseased condition of the zonula, caused by choroiditis with softening of the vitreous. If part of the vitreous escape before the cataract does, the hook or spoon should be instantly used to favor the exit of the lens. Should the vitreous escape with or after the cataract, it is best to close the lids at once, and apply a tight

bandage for a couple of hours, so as, if possible, to prevent intraocular hemorrhage and detachment of the retina.

LIEBREICH'S METHOD OF EXTRACTING CATARACT.—To escape the risks of Graefe's complicated plan of operating, Dr. Liebreich tried a new method, which is a modification of the flap operation, though the section is not entirely confined to the cornea. Prof. John King translated for the Eclectic Medical Journal (January, 1873), a pretty clear account of the operation, as described by *Dr. Manche*, in the *Jour. d'Ophthalmie* for 1872, page 507. The article runs as follows:

"Being convinced that the method of extraction adopted by Dr. Liebreich, since 1867, is the easiest of execution and the most certain in result, I have employed it in many cases, and I can say that I have obtained great benefits from it. I desire to describe it in order to exhibit these advantages, and especially with the hope that many practitioners (particularly those who have not yet had sufficient experience in any other method) may be able to profit by it on the first occasion.

"No one denies the superiority of the modified linear method of Graefe over the old method by flap, which, however, far from having fallen into oblivion, is still practiced upon a very great scale. The superiority is principally observed when the relatively small number of total suppurations of the corneæ are taken into consideration. Now the slightest tendency to suppuration after Graefe's operation, even where the cornea is thin and soft, among very feeble old persons (very unfavorable cases for extraction by the flap operation), is not due, as has been supposed, to the position of the incision made in the sclerotica, which is more disposed to cicatrization than the cornea, but rather, on the contrary, to the wound unavoidably made in the cornea. In fact, the wound made according to Graefe's method does not involve the sclerotica except at its superficial part, while its deeper part is found entirely located in the cornea alone. All the advantages of the modified linear method consist in the form of the incision, and the instrument with which we operate. The linear form of the incision, as near as we can make it upon a spherical surface, is the *sine qua non* condition for the coaptation of the margins of the wound; even if the cornea is very lax, the margins mechanically touch each other, and coaptation is perfect at

the moment in which the aqueous humor commences to accumulate. Besides, with this form of wound which in order to open requires appropriate manœuvres and pressures (which is not the case in the flap operation in which the wound opens upon the slightest movement of the eye), the precautions on the part of the surgeon and the patient are not so necessary as when the old flap operation is performed. Moreover, the more regular a wound is made, the more promptly will its reunion be effected. Now, everybody knows the difference that exists between the two operations. On the one hand we possess the facility of making a linear incision with a knife, the very form of which favors a regular puncturing; we may select the place for the counter-puncture, and often withdraw the instrument without the escape of any aqueous humor; by the easy changing of its flat surface, we have moreover the advantage of making the incision larger or smaller, and more or less approximating the centre of the cornea; on the other hand we do not experience the same difficulties as with the Beer's knife, with which even the most skillful surgeon is never sure of making a flap as he desires.

"Such are the real merits of Graefe's operation; but the *peripherical position* of the wound renders the method difficult, painful, and dangerous. In fact:

"1st. It is impossible to take out the cataract without making a large iridectomy, or without cutting a peripherical portion of the iris, as this forms a hernia in the wound; and besides, without iridectomy, the rotating movement of the lens, *in the flap operation*, by which that part of it nearest the wound is made to glide under the posterior surface of the iris in order to pass through the incision, can not occur.

"2d. The large iridectomy which is necessarily made, up to the margins of the incision, obliges the operator to make this incision above, if he would correct the subsequent dazzlings (circles of diffusion) with the superior lid.

"3d. The upper section is much more difficult to perform, and renders necessary, during the several steps of the operation, the employment of the dilator and the forceps for fixing the eyeball, which is painful, if not dangerous for the eye.

"4th. The position of this dilating speculum is frequently the cause of the prolapsus of the vitreous body, which is also facilitated by the peripherical section of the incision.

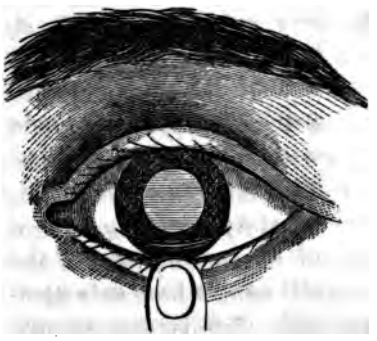
"5th. Prolapse of the vitreous body, and hemorrhage into the anterior chamber, are the chief obstacles to a careful removal of the *debris* of the cortical substance of the crystalline, the presence of which may become a cause of iritis. In fact, the cortical substance, which it has sometimes been impossible to expel, swells up, irritates the iris, interferes with its movements, and provokes and keeps up the inflammatory condition of this organ.

"To obviate these disadvantages, Dr. Liebreich has modified the process by removing the incision, nearly linear and made with Graefe's knife, more and more toward the centre of the cornea, in such a manner that this method preserves all the advantages of the method of the Berlin professor, while it avoids the greater part of its disadvantages. It is as follows:

"The patient lies on his back, chloroformized or not, the pupil having been previously dilated with atropia. For the right eye the operator stands behind the head of the patient, and at his left side for the left.

"There is no necessity for an assistant. The instruments needed are, a Graefe's knife (the smallest possible), a Daviel's curette, and a cystotome, all of which may be mounted on the same handles. Let us suppose the operation to be performed upon the right eye, (below and without iridectomy). The operator fixes the upper eyelid with the index finger of his left hand, at the same time slightly pressing the middle finger against the inner *canthus* of the eye. The knife held in the right hand, and directed horizontally with its back looking backwards, so that the flat part or plane of the blade makes with the horizontal meridian of the eyeball an angle of about 45°, is pushed into the sclerotica at a point about one millimetre externally to the margin of the cornea. Without changing the direction, the knife passes through the anterior chamber so as to make the counter-puncture on the

FIG. 45.

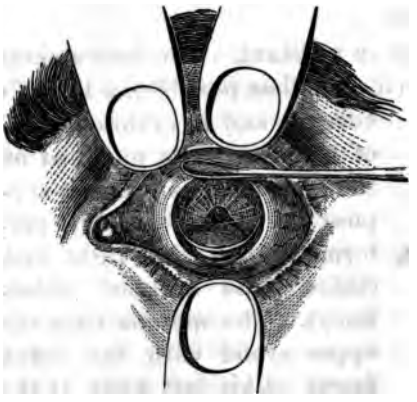


Liebreich's incision for the extraction of cataract.

opposite side, the point of the instrument passing out at about one millimetre beyond the internal margin of the cornea. The knife is now pushed forward, and when we withdraw it, we at the same time finish the incision, which is slightly curved, its central part being from one and a half to two millimetres from the inferior margin of the cornea, and almost wholly situated within this membrane. As soon as the incision is made, let the upper eyelid drop.

"The second step of the operation, when iridectomy is not to be performed, which is not always possible, consists in lacerating the capsule in the manner usually pursued. In the third step, we slightly press with the Daviel's curette against the inferior margin of the cornea, and, with the index finger of the left hand, which is rested upon the upper eyelid, we at the same time make gentle counter-pressure against the eyeball. Thus the lens executes a slight movement of rotation, its inferior margin is carried forward, presses (as in the flap operation) against the posterior surface of the iris, pushes it forwards, glides behind it, is carried to the pupillary sphincter, clears it, and passes through the wound, which is made to gap by the pressure made with Daviel's curette. This manœuvre is facilitated by a gliding motion of the index finger of the left hand which acts upon the upper eyelid from above downward. Similar movements with the lids must be made to force out the *debris* of the cortical substance, after we have pushed them into the pupillary field by gentle frictions upon the closed eyelids. If the pupil does not manifest its regular appearance after this operation, but is drawn downwards, we may restore it to its normal position and form by a slight friction of the lower lid drawn outwardly, and if this does not answer, by the introduction of a hard rubber Daviel's curette. Immediately after

FIG. 46.



Delivery of the lens through a Liebreich incision.

the operation, drop some atropia solution into the eye and close it with Liebreich's compressive bandage.

"What are the real advantages of this method?

"1st. The incision being nearer the centre of the cornea, one is not exposed to the disadvantages and dangers above mentioned, which are inseparable with Graefe's operation.

"2d. We may dispense with iridectomy, which is an immense advantage; or, if we perform it, we only make it very small.

"3d. Since the operation may be performed without iridectomy, the incision may be made downwards, which renders the operation much more easy and much less dangerous, for the drawing of the globe downwards, its fixation with the forceps, and the use of the elevator in the latter step of the operation of Graefe, are too frequently the cause of the prolapsus of the vitreous body, which hinders cleaning the eye or the expulsion of the cortical substance.

"4th. The operation being more easy, may be made by practitioners who operate only occasionally; and those, likewise, who can not attend special clinics or receive counsel from experienced operators, will find in this method all the resources of a good and easy operation, and will not be condemned to the method of depression or of reclination which, under the appearance of great simplicity, present the greatest dangers.

"5th. This process is preferable to the flap operation, because we have not to fear suppuration from the want of nutrition of the flap, and still more from the difficult coaptation and the irregularity of the incision; besides, even in the most unfavorable cases, the operator not being very skillful, owing to the simplicity of Liebreich's process and to the convenience of the instruments, extraction may be finished in the most satisfactory manner.

"6th. Finally, it is preferable to the method of Graefe, because the dangers are evidently less; and as to the final result, it yields in nothing to the *best* result obtained by the flap operation.

"This operation is applicable to all cataracts in general, with the exception of lamellar cataracts, those of childhood, and liquid or deprived of nucleus. Only we must be careful to make an incision (downward or upward, with or without iridectomy) proportioned to the size of the nucleus; that is to

say, when the nucleus is large and hard, the cortical substance tough, and the cornea small, the puncture and the counter-puncture must be made a little nearer to the horizontal diameter of the cornea, that the incision may consequently be more curved, and which is effected by inclining the plane of the knife blade at an angle greater than 45° from the horizontal plane of the eyeball. When iridectomy is performed, although small, it must be proportioned to the volume of the nucleus, besides which the previous state of irritation of the eye must be taken into consideration.

"At St. Thomas Hospital, Dr. Liebreich performed extraction, making the incision downward and without iridectomy, so that his process is reduced to the greatest simplicity, not requiring the aid of an assistant, elevator, fixation, or anæsthetics; two instruments sufficed. Besides, the method has the advantage of being, on the one hand, the least dangerous mode of extraction, and on the other of giving the best results. After the eye operated on is cured, it differs from the normal eye only by the absence of the lens and the presence of a hardly visible cicatrix of the cornea."

The removal of cataract is attended with unsatisfactory results in a larger proportion of cases than is generally supposed. The best operators have their "bad cases," though they have learned to avoid touching what promises little. The inexperienced are apt to conclude, without duly considering the subject, that cataract is a curable disease in all instances. They never stop to think that a disorganized eye will not see though a cataractous lens be successfully removed from it; that an opaque cornea will not transmit light; that an inflamed iris indicates pretty decidedly that the retina and choroid are not all right; and that a cataract operation is often unsuccessful when every indication is favorable. Sunken eyes, stiff lids, thickened conjunctivæ, vascular corneæ, and other complications of greater or less importance, constitute conditions which will impart a serious lesson to those who are reckless enough to attack every case of cataract they chance to meet. Results are impressively disastrous when all the conditions are propitious.

DISEASES OF THE VITREOUS HUMOR AND HYALOID MEMBRANE.

The vitreous humor, of the consistence of thin jelly, and of glassy brilliance, is a translucent mass of albuminous fluid, and contained within a delicate, transparent membrane—the *hyaloid*—which adheres quite firmly to the retina.

In old age the vitreous often exhibits a milky cloudiness which arises from a diffusion of fatty particles and a delicate precipitate of, perhaps, a saline substance. In syphilitic changes of the retina, the vitreous loses its perfect transparency, and becomes turbid; and in severe cases, flakes of lymph are seen freely moving about in it, appearing like tangled blackish threads.

After inflammation of the hyaloid, flakes, filaments, and corpuscles are seen floating about in the vitreous, and changing positions so rapidly that they can not be observed with accuracy.

CYSTICERCI have been observed in the aqueous humor and the vitreous. They are described as real entozoa, which generally are attached to the choroid, retina, or iris, but in some cases become detached and float freely in the translucent fluids. Although light-colored or nearly white, they are sufficiently opaque to intercept the rays of light, and, therefore, appear black.

HYALITIS may be caused by an injury, or result from disease of the retina. It is usually confined to parts about the optic nerve-entrance and the ciliary processes. As it can not be determined when the hyaloid membrane and vitreous are inflamed, unless there be a perceptible product, when the vitreous is clouded with a fine molecular detritus, it is assumed that an inflammatory process has been going on. True pus is developed in some forms of hyalitis, and its *debris* becomes diffused through the vitreous.

Extravasations of blood from the retinal vessels produce a darkening of the visual field, and inflammation of the hyaloid and vitreous. The blood at length decomposes, and its *debris* by sinking, disappears from the visual field, or appears when disturbed by movements of the eye.

SYNCHESIS is an abnormal fluidity of the vitreous. It sometimes comes on without inflammation or other disturbing cause or visible sign except it be by waviness of the iris and lens. When flakes are seen floating in the dissolved vitreous, and disappear by sinking when the eye is at rest, it may be presumed that the synchesis is accompanied with inflammatory action. Synchesis renders a cataract operation exceedingly dangerous.

As hyalitis and inflammation of the vitreous rarely occur without choroido-retinitis, or inflammation of other eye-structures, no separate treatment need be laid down for their management.

Cysticercus of the vitreous is to be removed by an operation. Graefe, after performing iridectomy and extracting the lens through a corneal incision, carried a pair of forceps into the centre of the vitreous, and, after seizing the parasite, dragged it from the eye.

THE OPTIC NERVE.

On account of the origin of the optic nerve in the brain an important portion of the visual apparatus can not be examined; and, consequently, a large share of visual defects, in common with many cerebral diseases, must forever remain subject to the uncertainties of theory and speculation.

No part of the optic nerve can be seen except its distal termination in the fundus of the eye. Its entrance has been denominated the "optic papilla," from the fact that early ophthalmoscopic observers thought they saw a slight prominence where the nerve enters the eye. Ophthalmoscopically the *entrance* of the nerve is all there is of it, therefore in speaking of healthy and morbid appearances it is better not to employ a distinct term for the spot where the nerve-trunk ends and the retina begins, but to call it *optic nerve*. In a healthy eye the nerve presents a plane surface, no *prominence* or *papilla* existing.

In examining the interior of the eye, no structure commands greater attention than the optic nerve. There is a

variety in its appearance in healthy subjects; and in disease a wide range of appearances is presented. Contrasted with the reddish tint of the surrounding retina, the nerve appears cream-colored, or it sometimes presents that faint tinge of pinkish-gray peculiar to the cineritious portion of the cerebral convolutions. The extreme edge of the disc is of a more decided white than the central portion. At the centre of the nerve—*porus opticus*—the main trunks of the retinal vessels—arteries and veins—may be seen, and their pulsations observed, or may be artificially produced by pressure upon the eyeball. Commonly each vessel issues as a single trunk, which then divides into branches, but sometimes the division into two or three trunks takes place before the vessels quit the substance of the nerve in which they are embedded.

Sometimes the variation in color observed in the disc depends much upon the size and form of the vessels, which may pass in straight or slightly wavy lines, or curve and twist

FIG. 47.

"Excavation of the optic disc."

on the surface of the nerve. In dark-haired individuals, with strongly pigmented choroids, the color of the disc is mostly much brighter than in blondes.

In patients affected with general dimness of sight (amblyopia), it is not uncommon to find a dusky halo surrounding the optic nerve, which shades off and is altogether lost at some distance from the disc, the peripheral portion of the retina presenting a natural appearance. Greater variations are compatible with good sight, therefore not much importance can be placed upon the dusky zone as evidence of serious structural change.

As age advances the tissue of the nerve appears to become denser, and to occupy a smaller space than in early life. Its

color, in some instances, becomes darker, or approaches to gray, while its outline deviates from the circular form, though these changes may coexist with a fair amount of vision.

Sometimes the optic nerve attracts attention by way of contrast with redness of the retina, the optic disc appearing as white as ivory. Atrophy of the optic nerve occasionally is attended with this whiteness by contrast with a reddened retina; the combination therefore is not a favorable symptom.

"Excavation of the optic nerve" has of late been esteemed of considerable importance in the diagnosis of certain eye diseases. It being met in cases of greatly impaired vision, and in combination with "intraocular pressure," is considered pathognomonic of "glaucoma." I have observed pitting of the optic disc without finding "stony hardness" of the eyeball, or evidence of inflammatory action in any of the deep structures of the eye. However, impaired vision existed, and a state which called for an ophthalmoscopic examination.

THE RETINA.

The retina is the expanded optic nerve within the eyeball. It is a layer of brain-like matter, pinkish-gray in color, and extends from the optic disc to the *ora serrata*. It is spread out smoothly between the choroid and the vitreous. An inexperienced ophthalmoscopic observer might overlook the retina, which appears in the fundus like a delicate bluish or pinkish-white mist or veil, and recognize only the retinal vessels which are quite prominent. The tint of the retina varies from grayish-red, through shades of orange-red to yellow or buff. The tint of the retina in a full-blooded person is redder and brighter than it is in the feeble and anæmic.

The vessels radiate from the central trunks in the optic disc to the periphery of the retina. The veins are thinnest and therefore the blood is plainest seen through their walls. By pressing upon the globe pulsation can be seen, both in arteries and veins.

The *macula lutea* is observed to be free of vessels; and by a peculiar reflection which the *fovea centralis* causes, it has the appearance of a bright spot of oval or semilunar form.

RETINITIS.—When the retina is inflamed a gelatinous lymph is exuded upon the surfaces of the retina, especially upon its

outer side, uniting the retina to the choroid. The exuded lymph is seen in extensive patches, with ragged borders. The exudation causes a cloudy opacity, which dims the visual powers.

Among the more striking appearances revealed by the ophthalmoscope are irregular deposits of black pigment on the illuminated field of the retina. These pigmentous deposits present endless varieties as to quantity and mode of arrangement. In one case two or three minute isolated dots may alone be visible; in another case the pigment may assume the form of fine threads, ramifying over a considerable portion of the retinal surface; while, in a third case, the pigment may be aggregated in large black masses, the intervening portions of retina presenting a normal appearance.

Extravasations of blood, from rupture of the retinal vessels, constitute a serious accident. The effused blood overspreads the tissue of the retina, and the entire field of vision may become a perfect blank. All this may occur suddenly, and without forewarning, like apoplexy, there being no congestion or cerebral disturbance. A slight hemorrhage may be less serious, the patient complaining of a variable state of vision, objects being seen in some positions or directions. There may be glimmerings, glitterings and tremblings in connection with dimness of vision.

The origin of retinitis is not always ascertainable. Excitement, feeble nutrition, injuries, and syphilitic taints may be enumerated as constituting the most common causes. Cerebro-meningeal diseases are frequently followed by retinitis. When other structures are involved in the inflammatory action, as the choroid and iris, the state of the pupil may indicate the nature of the disease, especially if circumorbital pains and defective vision are complained of. In times past such difficulties were put down as "glaucoma" or "amaurosis," and the patient was mercurialized, but the use of the ophthalmoscope has enabled us to determine exactly what structures are diseased, and the extent of the disorder.

Persons having Bright's disease of the kidneys are subject to what is called nephritic retinitis, a difficulty which is characterized by exudative deposits of fat and lymph in the meshes of the retina. As the disease upon which the retinitis

depends is incurable, the retinal complication commands less attention than it otherwise would.

DETACHMENT OF THE RETINA.—Chronic effusion of a watery fluid between the retina and choroid may take place in the most gradual and insidious manner, so as to manifest itself only by impairment of vision, there being no pain or outward signs of inflammation. When the retina has become detached to a considerable extent, a corresponding portion of the field of vision becomes a total blank so far as the perception of objects is concerned; while that portion of the retina which remains in apposition with the choroid may still distinguish even small objects, though in an imperfect and partial manner.

Subretinal effusion usually begins near the optic disc, and gradually descends to the bottom of the fundus—perhaps through gravitation. There are no external signs by which we can ascertain the existence of effusion beneath the retina. The ophthalmoscope alone enables us to detect it.

When a large portion of the retina has been separated, it presents the appearance of a lobular mass, of an opaque grayish color, contrasting in a remarkable manner with the reddish reflecting surface of that part of the retina which still retains its natural position. Myopic eyes are said to be predisposed to the accident.

In some instances, after the pupil is dilated, the detached portion of retina can be distinctly seen with the naked eye. With ophthalmoscopic aid the detached retina appears like a relaxed folded surface which is elevated above the surrounding parts, and trembles with every movement of the eye.

The results of subretinal effusion are far from satisfactory. In some instances the difficulty gradually subsides, but in most cases the detachment progresses steadily until all hope of restoration vanishes. Frequently the loss of one eye does not end the evil, the other becoming similarly affected sooner or later.

ATROPHY OF THE OPTIC NERVE AND RETINA.—Several of the morbid changes already observed, are followed by wasting of the true nerve-elements. Atrophy may occur without any known cause, unless it be from advancing age. The power of sight gradually fades away, until eventually mere percep

tion of light alone remains. The ophthalmoscope reveals a perfectly clear condition of the dioptric media, and at the same time affords such a complete view of the choroidal vessels, that the observer could almost fancy the retina to be altogether absent. The optic nerve is small and shrunken, irregular in its outline, and of a dark gray or drab color; and the vessels emerging from it form delicate, hair-like, red lines, barely traceable across the area of the illuminated choroid.

Treatment of Retinitis.—From what has been said of the varied morbid states of the retina, all of which were once grouped under the head of "amaurosis," and treated as one difficulty, it will be understood how foolish the attempt to lay down a course of treatment applicable to all of them. If there was a simple retinitis to manage, a rational plan of treatment might be devised for its cure or relief; but when the inflammatory action is complicated with atrophy of the nerve, detachment of the retina from subretinal effusion, extravasation of blood from the retinal vessels, and many other dissimilar conditions, and all accompanied with impairment of vision, what rational plan of treatment can be adopted which will affect any two of these morbid changes? In a group of patients making about the same complaints in regard to defects of sight, and, before the invention of the ophthalmoscope, all would be subjected to the same course of treatment, one sufferer is now discovered to have a portion of the retina overspread with blood; in another the axis of vision will be found covered with a patch of pigment; while in a third, the retina and choroid will be partially separated by an effusion! An English oculist very pertinently inquires if such patients are to be treated alike?

"Do they, in fact, possess anything in common? And yet they would all have been formerly classed together as 'amaurotic,' and probably have undergone salivation accordingly.

"If the ophthalmoscope had done nothing else than limit the wholesale administration of mercury in eye-diseases, it would have conferred an immense boon upon mankind."

Not much can be done of a positive character towards overcoming morbid conditions of the retina, and restoring impaired vision which depends upon such conditions. If the retinitis be connected with iritis, choroiditis, and intraocular pressure, the operation of iridectomy may afford indirect

relief. But in uncomplicated retinitis, except that of subretinal effusion, the treatment is that of *rest*. Strong light is to be avoided, and, of course, reading prohibited. In the worst cases a comfortable bandage is to be worn over the eyes; and after some improvement has been gained, smoke-colored glasses may be worn. Much attention is to be devoted to a proper regulation of the bodily health. Wretched digestion and its debilitating concomitants, aggravate the disease. Nux, veratrum, and arsenic are agents which usually produce a favorable effect if administered judiciously. Scrofulous, eczematous, and syphilitic taints should be discovered when they exist, and attacked with the iodides and other alteratives. The patient should be encouraged to cultivate a cheerful disposition, and should enjoy pleasant surroundings. It is next to impossible to cure a fretful and desponding sufferer. If the patient have any vices or depressing habits, an effort should be made to correct them.

The operation of puncturing the vesicle in detachment of the retina has been successfully performed in a few instances. After the pupil is dilated a double-edged needle is carried through the sclerotic four or five lines behind the edge of the cornea, and on through the vitreous to the swelling produced by the subretinal effusion, when the vesicle is to be punctured and torn, care being exercised not to wound the choroid and the retinal vessels. The operation is legitimate, but should be performed by an expert lest more harm than good be done.

THE CHOROID.

The choroid is a vascular and pigmentary tunic which lies between the sclerotic and the retina. It is pierced posteriorly for the passage of the optic nerve. In front it is bounded by the ciliary muscle and ligament; and the ciliary processes are its appendages. The pigmentary layer is on its inner or retinal surface; its outer surface is loosely connected with the sclerotic.

CHOROIDITIS.—A structure so highly vascular as the choroid must necessarily suffer from inflammatory attacks; but its

intimate relations with other structures necessitate a complex morbid action. An uncomplicated choroiditis could not exist, therefore it is not strange that ophthalmic writers, who had not the ophthalmoscope to assist in the demonstration of certain morbid conditions, yet did understand the anatomical relations of the choroid to the retina, iris, etc., should say so much about "choroido-retinitis," "irido-choroiditis," and other compound difficulties.

When examined ophthalmoscopically the choroid is yellowish-red, with a shade of brown. This appearance comes from a mingling of the red tint of the blood with the brown or black of the pigment.

The external layer of the choroid consists chiefly of veins, which are disposed in curves, and on that account are called *venæ vorticosæ*. Pigment cells, stellate in shape, are lodged between these. The middle layer is made up of an exceedingly delicate vascular plexus, which is called the *tunica Ruyschiana*. The internal layer resembles a tessellated pavement, whose appearance depends upon the arrangement of the pigment cells, which are hexagonal in shape. The venous branches of the vasa vorticosæ carry off the greatest part of the blood of the inner structures of the eye. These veins pierce the sclerotic and pass obliquely to its outside. The condition of the sclerotic, then, whether it be firm or yielding, has considerable influence upon the hæmostatic state of the choroid and iris. A constriction of these efferent vessels must result in "congestion" which necessitates intraocular pressure and "excavation of the optic nerve"—both prominent signs of choroiditis.

A state of partial blindness is a result of inflammatory action in the choroid and the structures in intimate relation with it. This "impairment of vision" receives the name of "amblyopia," and when the visual obscurity is more profound and the morbid action is more intense, "glaucoma" is the term used to designate the complicated defect.

GLAUCOMA.—Defective vision depending upon inflammation of the sclerotic, choroid, retina, iris, etc., and morbid changes in the vitreous, lens, and cornea, or upon more or less of these structures, especially upon irido-and choroido-retinitis, has so long borne the name of glaucoma, that it is difficult to get

rid of the term. Inflammation of the choroid and retina is attended with a sea-green reflection from the ocular fundus, hence the literal signification of glaucoma. But it will be observed that a term which only signifies a hue or tint is exceedingly inappropriate to designate the complex conditions usually ascribed to glaucomatous states of the eye.

AMAUROSIS.—This is another term in common use to indicate blindness depending upon morbid changes in the deeper structures of the eye, whether arising from inflammation, atrophy, or cerebral disturbances affecting parts which preside over vision. The witty reply of the old oculist, when asked what amaurosis meant, was once significant. It was as follows: "amaurosis is a condition of the eye in which the patient sees little or nothing, and the observer—less." Since the invention of the ophthalmoscope a variety of morbid changes can be seen in glaucomatous and amaurotic eyes; and a new phraseology is employed to designate the real state of the parts diseased. If all understand that amaurosis means inflammation of the sclerotic, choroid, retina, etc., the term may be continued without much confusion; but a state of impaired vision depends upon defects of the optic nerve and other conditions not inflammatory in character, therefore no single word can be employed which may convey a definite idea in regard to the pathological condition of an "amaurotic" eye.

MUSCÆ VOLITANTES often attend choroiditis. They appear in flecks and spots which float about in the field of vision. These spots change their position whenever the eyes are suddenly moved. Beaded filaments greatly annoy the patient, making him believe they are the forerunners of amaurosis or other serious ocular defects.

A peculiarity of the *muscæ* is that they float around in various directions, and, then, as the eye becomes steady, appear to settle down as if sinking in a fluid. It is difficult to determine the physical character of these floating spots, if they have any. A congested state of the choroidal vessels may be their origin. A person occasionally troubled with *muscæ*, will find them more numerous and variagated after alcoholic or other excitement; and especially after the eyes have been irritated with strong light. I know a healthy man

in middle life, who complained of floating spots in the field of vision for several years, and then all at once missed the annoyance. During the invasion I examined his eyes several times with the ophthalmoscope, and never could detect any morbid changes in the choroid or retina. If a person anxiously direct his attention to the dancing spectres, he will acquire the habit of multiplying them.

Being common attendants of some serious diseases of the eye, muscæ are regarded by those unacquainted with their comparatively harmless character, as evidence of approaching amaurosis or glaucoma. But assurance may be given to those who have no other sign of visual defect, that these spectres are not incompatible with excellent and enduring sight. The best way to get rid of the annoyance is to neglect giving it attention.

A class of persons engaged in pursuits which require prolonged looking at minute objects—such as lace-workers, engravers, and jewelers—from over-taxing the eyes, at length lose the power to see distinctly small objects at even close range. For awhile the defect may be momentarily removed by closing the eyes, the temporary rest lending freshness to the sight. However, the recuperation is not lasting. In time the field of vision becomes permanently misty, compelling an abandonment of every occupation which exhausts the visual power.

Age alone is sufficient to impair vision. Persons who have never abused their visual powers by protracted examinations of minute objects, begin to lose the ability to thread a fine needle at the age of forty; and need the aid of spectacles to enable them to read small type at the age of fifty. The visual defect does not arise from changes inflammation produces, but from an inability to adjust the eyes for near objects; and convex glasses, of thirty inch focus, are required to compensate for the loss of adjusting power.

The ophthalmoscope reveals the changes produced by choroiditis, such as extravasations of blood, effusions of lymph, deposits of pigment, etc., yet the appearance of the choroid varies so much in different individuals, that caution should be exercised in drawing conclusions based wholly upon ophthalmoscopic appearances. The choroid tints vary in persons of contrasting complexions; and the vascularity of the

choroid is far from uniform. Excavation of the optic nerve in an eye the sight of which is seriously impaired, is a prominent sign of choroiditis, or choroido-retinitis. Add to cupping of the optic nerve, a thrombosis in the choroid vessels, and irregular deposits of lymphoid and pigmentary substances in the choroidal stroma, and the evidence of choroiditis becomes reliable. The ophthalmic division of the fifth nerve has ramifying branches in and about the eye, which are apt to become painful when the deep structures of the eyeball are inflamed, therefore circumorbital pain not unfrequently attends choroiditis.

Patients who have no external signs of eye-disease, and are first led to suspect something wrong in the visual apparatus by a slowly advancing dimness of vision, appear surprised when informed that extensive changes of a serious nature have taken place in the choroid, retina, and iris.

The *treatment* for choroiditis is not essentially different from that recommended in retinitis. Aconite is to be used freely about the eye; strong light is to be cut off; the general health supported or improved by regulating the diet and administering iron, sulphur, phosphorus, the iodides, and bitter tonics.

The operative treatment for choroiditis, including the complex disorders usually ranged under the head of glaucoma, consists in the performance of iridectomy. The removal of a portion of the iris has the effect of a genuine neurotomy, and is analogous to the removal of a part of the *portio dura* for the relief of tic douloureux. The operation necessitates the evacuation of the aqueous humor, and thus temporarily relieves the intraocular pressure.

Since the introduction of iridectomy for the cure of glaucoma, the most brilliant results have been obtained; but, as might reasonably be expected, some failures have attended the operation. Not unfrequently harm has been done by performing the operation in unsuitable cases. Iridectomy as a means of cure is of greatest service in acute and sub-acute forms of choroiditis, and before the eye has become in any way disorganized by the progress of the disease. Whenever ciliary pain is present the operation is useful, both in restoring vision and in the abatement of suffering. In purely chronic, or non-inflammatory cases, where blindness steals on gradu-

ally without pain or other acute symptoms, the operation of iridectomy is absolutely useless, whatever the degree of intra-ocular pressure may be.

OCULAR TUMORS.

Attention has already been called to tumors of the lids, such as hordeolum, comedones, and miliary nodules; some of which are mere phlegmons that pass away and return again, like pustules or small abscesses. About the eyebrows cystic tumors of a sebaceous nature, with gelatinous, oleaginous, and honey-like contents, some of them containing hair, develop and continue as annoyances and deformities. The caruncle is liable to granulate, and form fleshy or warty outgrowths.

Mucous polypi develop in the nasal and frontal cavities, and by their size encroach upon the orbital cavity, protruding the eye. Cysts and fungous growths of the antrum, in their development press upward, and thus cause the eye to bulge (exophthalmos), producing that peculiarity of expression called "frog-face."

Myxomata, vitreous or jelly-like tumors, benign in character, fix themselves on the internal tissues of the eyeball, and develop to an extent which is destructive to vision.

Glioma is a medullary fungus, or outgrowth of the retina. As soon as the tumor attains any considerable size, its disorganizing effects are fatal to vision. The growth of a glioma is often luxuriant, and imitates the rapid development of true carcinoma. When it breaks through the lens and cornea, and appears a true fungus externally to the eyeball, its nature is still obscure, simulating cancer in many phases.

Sarcoma, so called, is occasionally an affection of the eyeball, and proves destructive and intractable. It is malignant in its tendencies, though this character may not be apparent at first. When its seat is in the dense tissues, its growth is slow and seemingly innocuous; but when the soft structures get involved, the proliferating power of the disease becomes manifest. Sarcoma may spring from any of the ocular tunics, but generally it begins in the choroid.

Carcinoma of the eyeball, and orbital cavity, commencing in any of the structures, has no unvarying phase, but shows every variety of form it does when developed in other regions of the body. It would be unprofitable to attempt to describe the ever changing features, especially as the result of the disease is commonly fatal. Excision of the eyeball may stay the destructive processes for awhile, but a renewal of the malignant tendency may be expected.

Epithelioma of the lids and superficial structures is often curable, at least to the extent of removal and subsequent cicatrization. However, if the disease attack the lachrymal passages, the hope of cure is greatly diminished.

Benign tumors of the orbital structures, not involving the eyeball, can generally be removed with safety, and if thoroughly extirpated, no fear of return need be entertained. In the removal of tumors about the orbit great care should be exercised that as little deformity and loss of function follow as possible. The operator is to guard against injuring the levator palpebræ muscle lest ptosis follow; a cicatrix may establish trichiasis; and an injury to the lachrymal sac may result in fistula.

Little can be done with intraocular tumors; they have been known to go away without being plied with remedial measures, yet such is not to be expected. Gliomata can be seen distinctly with the aid of the ophthalmoscope, yet seeing them and their removal are quite different affairs. Tumors of the retina and choroid in the beginning often produce amaurotic and glaucomatous symptoms, and the real condition is only determined by ophthalmoscopic examinations. When intraocular tumors are syphilitic deposits, active treatment may bring about retrogression.

Intraocular tumors which protrude through the cornea or sclerotic often demand enucleation of the eyeball. Excising the protruding mass does very little good, as it is soon reproduced.

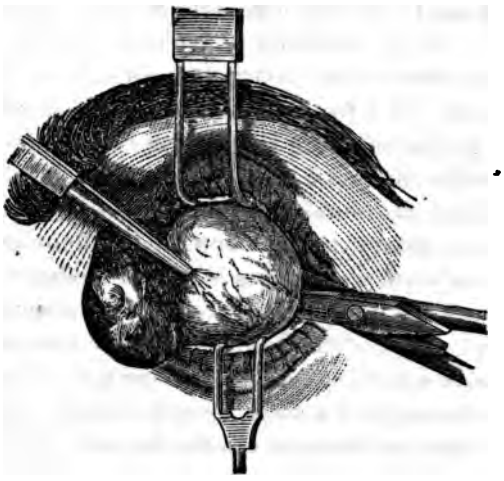
REMOVAL OF THE EYEBALL.

The entire removal of the eyeball leaves no "stump" on which an artificial eye can rest and move, therefore partial extirpation is to be preferred when the conditions will permit.

Complete extirpation is occasionally necessitated by the presence in the eye of foreign bodies, injuries and staphylomas of a disorganizing nature, malignant diseases, some intraocular tumors and insufferable neuralgia.

The danger from enucleation of the eyeball is not trifling, yet not so threatening as to forbid an operation under pressing demands. In fact, the eyeball has been extirpated for cosmetic

FIG. 48.



Amputation of the eyeball.

purposes, when disorganization of the globe was repulsive, and an artificial eye could probably be worn with ease and good effect.

The operation is executed while the patient is under anæsthetics; a spring speculum may do to hold the lids apart, yet retractors in the hands of assistants are better. If the eye be so enlarged that it will not come out through the tarsal fissure, the space is to be increased by dividing the outer commissure, the incision extending to the bony margin of the orbit. A fold of conjunctiva is seized over the insertion of the external rectus, and a free incision is made in this membrane with

scissors. Through this wound in the conjunctiva the rectus muscle is grasped with strong toothed forceps, and held steadily while a circular incision is made in the conjunctiva with curved scissors. Then the external rectus is divided a little distance back, and the near end is seized with reliable forceps, and the eyeball pulled forwards and rolled inwards, while a pair of scissors is used to divide fascias and the upper rectus and superior oblique muscles; after these are divided the lower rectus and inferior oblique may be served in the same way. The scissors are next carried back along the sclerotic to the optic nerve, and that is then divided. The globe now starts forward, and a few snips of the scissors divide the internal rectus, vessels, bands of areolar tissue, and whatever prevents the removal of the eyeball. The operation is thus completed, and the hemorrhage will prove to be inconsiderable. If the bleeding be troublesome the finger may be carried into the orbital cavity and pressure applied to the divided vessels. In a few minutes the hemorrhage will generally cease. If the bleeding still be persistent the cavity may be packed with lint and the tampon held in place with a bandage. The lint should be removed the second day, as it provokes unnecessary suppuration and inflammation. If a tampon be not used, a compress is placed against the lids, and retained with a bandage. The wound is to be redressed every day, and kept clean. The drainage affords moisture enough, therefore water and medicated fluids are not called for. The injury inflicted requires a week or two to heal. In the course of a year or less, an artificial eye can be worn, which supports the shrunken lids, and hides and disguises the defect and deformity.

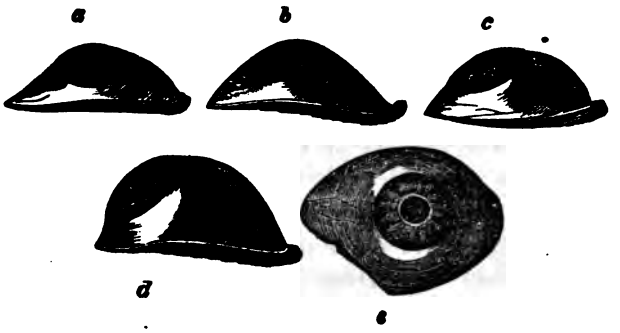
ARTIFICIAL EYES.

An artificial eye is made of enamel, and in shape is the segment of a sphere. It is used after abscission or amputation of the eyeball, generally after the cornea, iris and lens are removed. Its object is to lessen the unpleasant appearance produced by the absence of a part or the whole of the globe. The shell, when in place, restores the normal fullness

to the lids, and prevents the eyelashes of the inverted lids from jagging the conjunctiva and delicate parts within the socket. It re-establishes the power of winking, and renders possible the normal conduction of the lachrymal secretion.

Before an artificial eye is inserted the lids and the stump of the eye must be examined to ascertain if everything be in a favorable state for the insertion. The wound which destroyed the eye may have been followed by the adhesion of the tarsal borders of the lids to the stump of the eyeball. The union is commonly not extensive, but in bands or bridges of neoplastic tissue. These false connections must be severed before the artificial shell can be introduced. This is generally done with scissors; and the presence of the shell between the traumatic surfaces obviates re-union.

FIG. 49.



Artificial eyes.

To select an eye which is of proper size and form to rest easily beneath the lids, and in size of pupil and shade of iris to closely match the sound eye, is a difficulty little appreciated by the inexperienced in such matters. It requires a large stock to select from, and then a perfect or even tolerable match is rarely attained. An artificial eye costs from five to ten dollars, therefore few oculists can afford to keep a large assortment.

The size of the shell must conform to that of the stump. If a considerable portion of the eyeball has been excised, the artificial eye must be of extensive dimensions; and if the globe is merely atrophied or shrunken, there is only room for

the smallest pattern of a shell. When the eyeball is entirely gone the artificial substitute should represent at least a hemisphere.

The shell is hollow posteriorly, yet rests upon the stump and receives considerable motion from the muscles which have not lost all of their action. Should the shell be too large the pressure of the lids restricts the motions of the stump; and should the artificial eye be too small, the stump moves without imparting motion to the shell.

An artificial eye should be moistened with saliva and introduced while the patient's face is held over a bed or cushion, so that if it falls it will not hit a hard substance and break. In introducing the shell, the upper lid must be raised, and while the patient looks downwards, the upper edge of the artificial eye is pushed beneath the lid, which is then allowed to descend; and the lower lid being in turn depressed, the inferior edge of the shell is pushed into the lower palpebral sinus, and the insertion is complete. At first the artificial eye may feel uncomfortable, and can not be worn but a few hours at a time, but a few days or weeks experience do away with the discomfort.

It requires tact to remove an artificial eye, especially if the shell stick fast in its bed. The lower lid is to be turned down or everted, and the thumb-nail or a thin spatula of wood forced beneath the lower edge of the shell, to act as a lever to pry the artificial eye from its place. The shell is then pressed downwards by the upper lid, and it falls into the hand, or upon a cushion ready to receive it.

An artificial eye should be removed and properly cleaned before going to bed; and re-introduced in the morning. The shell should be wiped with clean lint, and occasionally dipped in whisky or cologne, to cut the animal substances which adhere to it. If dropped from the socket into cold water the sudden change of temperature may check the enamel or break the shell. Artificial eyes are exceedingly fragile, therefore great care must be exercised in handling them. A good shell, if not broken, will last for years. The enamel at length loses its polish and lustre, and a new eye is then desirable.

INJURIES AND DISEASES OF THE ORBIT.

Violence inflicted upon the os frontis, malar, or superior maxillary bone, may start a fracture which will extend to the thin plates constituting the orbital walls. Complicated with the fracture may be laceration of the periosteum and the soft tissues between the eyeball and its socket. If the fracture reach the frontal or maxillary sinus, or the ethmoid cells, emphysema is likely to occur. Extravasation of blood into the loose tissues produces swelling and discoloration. The inflammation following such injuries is apt to be severe. The cicatrization may establish permanent deformities in the ocular apparatus. The orbitar plates are occasionally broken by what is known as *contre-coup;* the force being received on the vertex or posterior region of the skull, does not produce a fracture at the point hit, but extending to the opposite pole of the cranium, causes a fracture there. If the orbitar plate of the frontal bone be thus broken, the effusion of blood will be observed in the upper lid; if the floor of the orbit be broken, ecchymosis of the under lid will occur. The extravasation of blood may be the only symptom of orbital fracture.

Bullets and other missiles may enter the orbit by going through the soft tissues in front, or by penetrating the bones constituting the orbital walls. The entrance inflicts dangerous wounds, and the continuance of the foreign body in the orbit may result disastrously to vision.

Penetrating wounds of the orbit may prove unimportant, yet from the beginning they are to be regarded as serious, if not dangerous. The instrument may pass through the orbit without doing much damage to the ocular apparatus, yet inflict a fatal injury to the brain or structures within the skull. Penetrating injuries of the orbit have been considered trivial at first, yet have resulted fatally in a few days.

Gun-shot and punctured wounds of the orbit should be probed or explored to ascertain if any foreign body is to be extracted, unless it be positively known that nothing is left which can do mischief. Pistol bullets and bird shot have remained in the orbit for years without doing serious harm, yet they form exceptional cases. Generally such wounds can be enlarged with safety, care being taken to avoid important

structures, and the foreign bodies sought and extracted. It is to be borne in mind that a bullet or shot may glance after entering the socket, and lodge in a position quite inexplicable, except on the ground that the missile took a circuitous route. It is not advisable to inflict severe injuries to extract what may not prove dangerous if let alone. Splinters of wood will induce suppuration, therefore they should be removed at once if possible. The sclerotic is so thick and dense that none but sharp instruments are apt to penetrate its walls.

Inflammation of the tissues between the eyeball and the socket, periostitis, and necrosis, are among the difficulties which may affect the orbit and the structures it encloses. Tumors develop in the orbit, and hypertrophy of structures behind the eye may produce exophthalmos.

Inflammation of the orbital tissues is to be managed on the same principles as inflammation in other parts of the body. Cold applications, poultices, fomentations, and anodynes, constitute the local agencies to be employed.

Periostitis is to be subdued chiefly by the internal use of iodide of potash. The pain may call for anodynes. If the affection depend upon a syphilitic taint, the treatment should be modified accordingly, though iodide of potash in large doses would then be one of the best agents which can be employed.

Necrosis can not be forced into subjection, but the disease will have pretty much its own way. To be sure the dead bone can sometimes be removed by a simple operation, yet there is no security against the dying process continuing. The suppuration will establish fistulous tracts for the escape of pus, and these can be used for the injection of carbolic acid or other agents presumed to exert a restraining influence upon the progress of the disease.

Tumors whether cystic or fibroid in nature, can generally be removed with celerity and safety. If their development is from a point deep in the orbital cavity, the eyeball is protruded by their increasing size, and their removal is not unattended with danger.

When the diagnosis of orbital tumors is obscure the exploring needle may be employed to help decide upon the nature of the disease. The contents of a hydatid cyst may

be discharged through the puncture an exploring needle has made, yet the cyst will refill.

Scirrhous tumors of the orbit are not essentially different from kindred growths in other regions; nor is the treatment to be conducted upon a plan peculiar to the location of the disease. Extirpation of the malignant growth may be allowable in some instances, yet surgical interference is generally of little avail, the disease reappearing to bring discredit upon operative measures in general.

Epithelioma is a less malignant and destructive form of cancer; and may sometimes be removed without recurrence, especially when the system is plied with renovating agencies.

BASEDOW'S DISEASE.—Enlargement and pulsation of the orbital vessels, with hypertrophy of the thyroid gland, and functional or organic disease of the heart, constitute a group of disorders occasionally associated in one patient. This complication of pathological conditions has gotten the name of "Basedow's or Grave's Disease." The most prominent feature of this morbid action is exophthalmos or bulging of the eyeballs. Females are more subject to the disease than males; and suffer most just after the menstrual function is established. The nervous system at this age is impressible and excitable, and the palpitation is a result. The veins about the neck are enlarged, and sometimes pulsate. The goitre is not necessarily large, nor need the eyes protrude enormously. The palpitation sometimes comes on in paroxysms, and may depend upon derangement of the menstrual periods.

There is no specific cure for this complication of morbid conditions, yet certain remedies exert a favorable influence, especially veratrum. This should be administered steadily in as large doses as the patient will bear without vomiting being excited. The medicinal agent will lessen the palpitations and pulsations and otherwise exert favorable influences. Iodides, bromides, and ferruginous preparations have been given without appreciable effects. Cases frequently recover, though the course of convalescence is tedious.

VISION AFFECTED BY INTRACRANIAL DISORDERS.

Vision is occasionally impaired, disturbed, or destroyed by disorders which are cerebral or intracranial. Tumors of the brain may affect vision by pressure upon the optic nerves or the cerebral substance giving origin to those nerves. Apoplectic clots, and abscesses of the brain may affect vision in the same way that cerebral tumors do. Meningitis, especially the cerebro-spinal variety, is a frequent cause of partial or complete blindness. The disease is attended with meningeal effusions, and followed by the organization of exuded lymph, either of which may press upon the optic nerves directly or remotely, and disturb vision. Severe cases of cerebro-spinal meningitis have been followed by incurable blindness and deafness. Pressure upon the motor nerves of the eye destroys the parallelism of the two eyes; and pressure upon the fifth pair leads to ulceration of the cornea and other defects of the ocular apparatus. Abnormal deposits, whether from neuritis, periostitis, or meningitis, which interfere with the conduction of nerve-force along the nerve-tracts, impair vision, and develop squinting.

Cerebro-spinal paralysis may not be of the same severity on both sides, and thus destroy harmony of action in the two eyes. Paralytics rarely escape some degree of visual distortion. Inflammation of the brain, especially in children when a convulsive tendency is present, by its products compressing intracranial nerves, is often attended with distortion of the eyes, and complicated visual defects. The disturbance may not be continuous, but vary with the intensity of convulsive action.

Tuberculosis and syphilis are among the common causes of ocular defects, especially when morbid deposits are located in the vicinity of the optic nerves. Complicated with the visual disturbances there may exist aphasia and other functional defects having a cerebral origin. Gummy masses in the brain, generally developed in syphilitic subjects, are frequent causes of impaired vision in obscure cases where no other morbid influence can be traced or reasonably suspected. Gummatous deposits along the course of the motor nerves have been known to produce squinting, ptosis, and bulging of the eyes.

Thrombosis and hemorrhagic extravasation, neither of which need be syphilitic in origin, may induce ocular distortion by compressing the motor nerve trunks. Exostoses have, by exerting compression, disturbed the visual functions, producing diplopia, amblyopia, and paralysis of the motory apparatus.

The treatment of visual defects depending upon intracranial diseases is not generally very satisfactory; something may be accomplished by the discreet employment of constitutional remedies, when the disturbing element is systemic. But what can be done towards the removal of exostoses, or brain tumors? It is probable that a robust state of health is most favorable to the removal by absorption of abnormal deposits, therefore attention to the general functions of the body would be rational. A hemorrhagic extravasation may be removed by absorption, or so diminished that the disturbance caused by it may cease. Syphilitic deposits may be removed by the action of large doses of iodide of potassium. In some cases where the venereal taint is known to exist, and gummata in the cranial cavity are suspected, from thirty to sixty grains of iodide of potassium may be taken three times a day for a week or more; and good and not bad effects be counted upon. After a season of rest, the medicine should be prescribed again, syphilis being a disease which, though routed for awhile, is inclined to renew its attacks. The bromides and hypophosphites are in good repute as agents to act upon nerve-centres, yet they may not always exert a beneficial influence. Galvanism has been known to favorably impress in obscure cerebral difficulties, yet the indications for its use are not well-defined. The agent rarely does harm. Necrosis, periostitis, and exostoses of the cranial bones can not be overcome at once, therefore eye affections depending upon either of these morbid processes are likely to be chronic. Necrosis of the sphenoid has produced incurable blindness, the disease extending from the cells to the body of the bone, upon which is the optic chiasm.

Intracranial diseases being obscure, and beyond the reach of topical applications, their management can not be undertaken with confidence. Phosphorus has been administered with beneficial effects in softening of the brain, though the visual disturbances depending upon the disease, have not always been corrected by the use of the medicinal agent.

MYOPIA.

The ability of the eye to adjust its dioptric apparatus, so as to see objects distinctly at different distances, is called the power of *accommodation* or *adaptation*. If the refractive media be defective or the adaptive power be abridged, the *range* of vision is restricted. If a person can see objects only when they are near, while distant ones appear dim and confused, the defect is that of "short-sightedness"—*myopia* exists. The sight, under such circumstances, may be *clear*, but it is limited to short range—to close views; and is only *dim* when applied to objects at a distance, or beyond its range.

There is a popular notion that excessive convexity of the cornea is the cause of "short-sight," yet such is not generally nor necessarily the case. A fish is short-sighted, though its cornea is flat; a bird of prey is far-seeing, yet its cornea is exceedingly convex. The cause of myopia, then, must be sought in other parts of the dioptric mechanism. It may not always be the same in different short-sighted people, yet the changes of curvature in the cystalline lens, brought about by the action of the ciliary muscle and the elasticity of the lens, have much to do with "adaptation."

The defect may be hereditary, though acquired by using the sight at short range by ancestors. It is rare among savage or uncivilized nations, and among persons engaged in out-door employments; while it is common among those devoted to in-door pursuits. Literary people who engage in reading and writing for hours together during a considerable portion of life, lose the power to see distant objects clearly. The same may be said of artisans and of those who are engaged in minute and delicate manipulations. A child is rarely myopic, but the defect comes on a little before puberty, and increases till about the age of twenty-five, when the focus settles into what is to continue for the rest of life. It is a popular folly to suppose that as the cornea flattens in advanced age, longer range of vision is attained.

In myopic eyes the rays of light which ought to come to a focus upon the retina, converge to a point in front of it. This defect arises from an elongation of the globe in its antero-posterior axis, or from the lens being too convex, a

state due to the ciliary muscle, as it is the active agent in altering the curvature of the lens.

Haziness of the cornea and lens induces the patient to hold objects near the eye for careful examination, and this exercise tends to develop myopia. When short-sight exists the cornea and lens should be critically examined, as opacity of these media may be the true cause of the myopic manifestations.

Snellen's test types, to be found at the end of this volume, are useful in detecting the acuteness of vision in a given case. The following rules, from Dr. Snellen, have been formulated:

"I. The smallest angle, at which objects of known size and form can be distinguished, determines the degree of the relative acuteness of vision.

"II. To determine the smallest visual angle, we measure the utmost distance at which objects of definite size can be recognized.

"III. A visual angle and corresponding distance being taken as the unit of measure, the proportion between such distance and that at which the object is actually seen, *expresses the acuteness of vision.*

"IV. We take as a unit of comparison the recognition of letters seen at an angle of five minutes.

"V. The numbers placed above each type express in Parisian feet the distance at which the letters are seen at our standard angle of five minutes.

"VI. The utmost distance at which the types are recognized (d), divided by the distance at which they appear at an angle of five minutes (D), gives the formula for the acuteness of vision (v.)

$$v=\frac{d}{D}$$

Thus if d and D be found equal, No. XII, of the test types being recognized at a distance of 12 ft. $v=\frac{12}{12}=1$; in other words, there is normal acuteness of vision. If, on the other hand, d be less than D, and if No. XII. be only visible within 6 ft. or VI. within 2ft. or No. XXX. at 20 ft.,

$$v=\frac{6}{12}=\frac{1}{2}$$
$$v=\frac{2}{6}=\frac{1}{3}$$
$$v=\frac{20}{30}=\frac{2}{3}$$

but d may sometimes be greater than D, and No. XII. be visible at a greater distance than 12 ft.; in this case the acuteness of vision is greater than the normal average.

"VII. The normal acuteness of vision decreases with age.

"VIII. The value of *v* should be found equal in testing with the different types, each in its corresponding distance. If such be not the case, and *v* appear to diminish considerably within or beyond a certain distance, it may be inferred that the refraction is at fault, or that the eye is not adjusted for such distance."

The optical remedy for short-sight consists in the use of concave glasses of a focus suited to the individual case. If glasses can not be found which enable the patient to define distant objects with accuracy, the defect is not wholly myopic, but springs from faults of another nature.

In selecting glasses for the young, an excess of concavity should be avoided; and an increase of concavity admitted only when it becomes absolutely necessary. Young persons who are slightly myopic may require a low concave power only when reading music, or examining objects which can not be brought near the eye. When they have reached the age at which the eye settles into its permanent focus, they may, according to circumstances, either permanently adopt spectacles, or occasionally use an eye-glass. The latter should always be made with a glass for each eye. The practice of using a single glass is prejudicial to the eye which is unemployed.

American opticians follow the French and German methods of numbering glasses whether concave or convex. Thus, "No. 1" means glasses which are *most* convex, or *least* concave; "No. 2" is more so, each successive number indicating an increase in the convexity or concavity; and every number expresses the focal distance of an inch. "No. 20," for instance, would imply that the focus of the glass was twenty inches, whether convex or concave, and the convexity of "No. 30," for instance, exactly fits the concavity of "No. 30," and so on from the beginning to the end of the series.

PRESBYOPIA—HYPERMETROPIA.

When refraction and accommodation render small and near objects indistinct, while distant ones are seen clearly, the defect is called presbyopia or hypermetropia, and is also designated as "long-sightedness." The difficulty is not necessarily the result of age, although eyes affected with presbyopia seem to be flattened in their antero-posterior diameter, as they are in advanced life. It is occasionally met in young persons—even in children—and it is also a frequent result of exhaustion in the nervous and muscular powers of the eye in consequence of over use. A disproportion in the diameters of the eye is the prevailing cause of myopia and hypermetropia. In the former defect the rays of light, entering at the pupil, come to a focus in front of the retina, and in the latter they come to a focus behind it. Long-sight may be due to insufficient convexity of the lens—from want of power to move it in that slight degree necessary for due adjustment—as well as from the antero-posterior diameter of the globe being too small.

Young persons having presbyopic eyes are apt to fall into the habit of viewing small or near objects with one eye—binocular vision being impracticable—and thus acquire a peculiar squint, the strabismus being convergent. The squint is temporary at first, but in time it becomes permanent. If the use of convex glasses does not overcome the strabismus, it is best to divide the internal rectus which has by prolonged exertion acquired preponderating power over its antagonist.

Persons who in early life have had remarkably acute sight for distant objects, commonly find, as they approach the age of fifty, that reading becomes more and more difficult. The book is placed farther off, and at last is held at arm's length. The effort is attended with a sense of strain in the eyes, which can not be prolonged without pain. Glasses of low convex power—say of twenty-four inches focus—at once remedy the defect, reading being resumed with ease and comfort.

In examining hypermetropic eyes it is well to use Snellen's types; the imperfection of vision when thus tested, will be found at the extremes of visual range, *i. e.*, at the near and far points. The larger types at the longest distances will

probably be seen with greater distinctness than the smaller ones held close to the eyes. A presbyopic patient, when examining near or distant objects, strains the ciliary muscles and the internal recti to gain the advantage which the convergence of the optic axes affords in increasing the power of accommodation.

In testing hypermetropic eyes it is often advantageous to ascertain whether the defect is due to the flattening of the eyeball or to impaired accommodation. If a patient can at a distance of twenty feet, read No. 20 of Snellen's test types, with a No. 20 convex lens, and, upon paralyzing the ciliary muscle with atropine it requires a greater convexity in the glasses, say No. 10, to read with equal distinctness, the difference between these lenses expresses the amount of accommodation employed before the atropine was used.

In the common forms of hypermetropia convex spectacles remove all difficulty in reading. In order to ascertain the number of the glasses to be selected that the defect of vision may be corrected, the patient should be asked to read No. 20 of Snellen's test types at a distance of twenty feet. He may now try to read the types with No. 30 convex glasses, and then with No. 20, ascertaining experimentally the *lowest* power (highest numbers) of glasses with which the types can be clearly read without effort, the higher powers are objectionable inasmuch as they tend to increase the defect. The glasses should be worn only while reading or writing, or while necessary to examine minute objects. If aid be required for viewing distant objects, a less convex form of glass should be used in observing them.

Presbyopia, which, as has been intimated, is a defect in the accommodating powers of the eye—a fault which may lie in the ciliary muscle or the form and consistence of the lens—is apt to increase with age, therefore as the patient grows older the focal power of his spectacles must be increased. No. 36 may be strong enough at the age of twenty, but No. 20 may be needed at the age of sixty. It is common for hypermetropes to look over their glasses when suddenly called to view distant objects.

Hypermetropia, strictly speaking, or as now defined, is a defect of vision depending on a want of refractive power in the dioptric media, as the curves of the cornea and lens, and

the antero-posterior diameter of the eyeball, therefore changes for the worse, as age advances, are not so common as in presbyopia where the defect depends upon impaired muscular action. As the two states generally exist in common, there is little advantage gained by attempts to draw fine lines of distinction between presbyopia and hypermetropia. Both defects are remedied by convex glasses; and the proper focal power of the spectacles can be obtained experimentally. To be sure, the use of atropine, by paralyzing the ciliary muscle, will determine what proportion of the defect is accommodative, or depending on muscular action, and, by inference, what is refractive, or depending upon the dioptric media.

ACRITOCHROMACY, OR. INABILITY TO DISCRIMINATE BETWEEN COLORS.

Certain individuals are unable to discriminate between colors, or to apppreciate different colors. The defect may be called *acritochromacy*, though a half dozen other technical terms, highly compounded, have been invented to express the visual abnormity. The peculiarity has been called Daltonism, after the celebrated chemist, who could not recognize several distinct tints, and published, in 1798, some speculations upon the subject. Dalton could appreciate blue, and supposed that a blue tint of the vitreous humor was the cause of the personal peculiarity. In accordance with an expressed wish, his eyes were examined after death, but as might have been expected, if the cause had been understood as it now is, nothing unusual was discovered. The cause of "color-blindness" resides not in the eye, but in that portion of the brain to which the impressions of light are conveyed. The defect in most instances appears to resolve itself into inability to perceive red. Yellow and blue are generally appreciated. The compound tints which are doubtful in their impressions are those into which red enters to a greater or less extent. Many persons fail to distinguish clearly between blue and green, and to quickly make out the difference between other allied colors. Among those individuals who are unwilling to admit they suffer any degree of defect in the appreciation of

colors, there exists a variety of opinion in regard to tints and shades of color, which is very interesting.

Sometimes acritochromacy is temporary and depends upon some bodily ailment. Persons suffering from jaundice claim that everything bears a yellow hue. Disease of the brain has been attended with a faulty perception of colors. Lead-poisoning produces violet vision; and certain medicines in large doses temporarily derange the powers which appreciate colors.

HEMERALOPIA AND NYCTALOPIA.

Intense light, direct or reflected, produces a dazzling effect upon the eye which is followed by inability to see distincily except in broad daylight. The derangement in the visual powers is called hemeralopia which means, in its literal signification, "day-sight." Persons who have taken sea voyages in the tropics suffer most from the affection. Sailors attribute the difficulty to sleeping on deck with the eyes exposed to the moonbeams. The real cause is to be attributed to exhaustion of the nervous power of the retina from over-excitation produced by the sun's rays, so that the weaker stimulus of twilight and moonlight will not make an appreciable impression. "Snow blindness" is a defect of a similar nature, the eye having been subjected too long to an intense reflected light. Hemeralopia is occasionally met in temperate regions, the cause being analogous to that which produces the defect in the tropical belt. Defective nutrition may contribute to the visual derangement.

NYCTALOPIA literally signifies "night-sight," and implies that vision is more distinct at night than during the day—the converse of hemeralopia. Persons who have a super-sensitiveness of the retina, being dazzled by intense sunlight, can see better in the evening than during the day, hence they are called nyctalopes, though they are not truly such, as are bats and owls. Nyctalopia is a morbid condition produced by inflammation of the retina, and may be regarded as a phase of "amaurosis." An irritable form of corneal inflammation,

attended with photophobia, may compel a sufferer to peep out only at night or when the light is dim, and thus the defect may seem to be a species of nyctalopia. However, a careful examination of the eyes will soon determine whether the "night-seeing" is a peculiarity—an idiosyncracy—or the result of inflammatory action.

ASTHENOPIA.

Inability to *prolong* an adjustment of the dioptric apparatus for short distances, faulty refraction, and lack of power to continue the use of the eye without confusion of sight, constitute ocular defects which have been grouped under the term "asthenopia."

When a person endeavors with two eyes to follow an object—say a coin—which is brought nearer and nearer from a distance where its outline can be distinctly made out, to a point close to the face, the eyes will be observed to converge by the action of the internal recti muscles, so that the rays of light proceeding from the coin fall upon precisely corresponding spots on both retinæ. But, if the internal recti be weak or not under control, the external recti prove too powerful for their antagonists, and the eyes will lose their normal steadiness, and soon become everted, one more than the other, so that the pictures of the object viewed fall unsteadily upon dissimilar points of the retinæ, and imperfect vision results. This is called *motor asthenopia* from the fact that the muscular apparatus is at fault.

Patients who are normally myopic may suffer occasionally with asthenopia. They use the eyes while examining minute objects in a state of constrained convergence, until the internal recti are tired, and then the external recti exert a predominance of force, turning the eyes outward. Rest must then be taken to allow the internal recti to regain their accustomed vigor. If an attempt be made to continue the use of the eyes after the muscles are exhausted, the objects viewed will become confused, and pain sets in from futile efforts to see, and from congestion of the choroid.

In motor asthenopia the patient is often troubled with

double images. This annoyance comes from the fact that the rays from the object viewed do not fall upon spots corresponding in the two retinæ. Myopes are frequently harrassed with double vision, especially while reading, the letters running together, and blending in inextricable confusion. Patients who persist in reading after the double images appear are obliged to shut one eye, or fix the weak one with the finger. However, make-shift advantages gained by such expedients are not lasting, and often terminate in serious injury to vision.

Motor asthenopia can generally be demonstrated by asking the patient to look steadily at a small object which is moved gradually towards the face. When the object is approaching within a few inches of the nose, one eye—the weaker—begins to oscillate, and finally inclines outward, making vision indistinct.

The existence and the amount of asthenopia may be tested by the use of a prism, whose refractive angle is up or down. If a black spot a quarter of an inch in diameter be made on a sheet of paper, and a perpendicular line be drawn through the spot, and then a person who is emmetropic (normal-sighted) be directed to look steadily at the figure while a prism is held before the eyes, two spots will appear, one directly above the other. But if asthenopia exist in either eye, one of the spots will appear to the right or left of the perpendicular line. This deviation proves the existence of asthenopia; yet the degree of deviation is to be demonstrated by the use of a second prism in front of and across the first, when the angle of the prism required to restore the spot to its position on the perpendicular line will indicate the amount of the diplopia. By testing one eye, then the other, it may be determined whether both eyes are affected alike, and the degree of difference, if any exist.

Motor asthenopia is remedied by the use of properly selected spectacles; and sometimes cured by dividing the external rectus muscle. Concave glasses remedy the defect by permitting the patient to see distinctly without bringing the object viewed too near the eyes. Prismatic glasses have been constructed with the view of bending the rays of light upon corresponding points of the retinæ.

If tenotomy of the external rectus is deemed necessary to correct the evils of motor asthenopia, great care should be

exercised in the performance of the operation lest by the entire division of the muscle the defect be converted into a convergent strabismus. Partial division of the muscle will commonly render the antagonism equal; and it is safer to cut too little than too much, as a second operation is always practicable.

Accommodative asthenopia is similar to the motor variety, the difference consisting chiefly in the part which is defective. In the accommodative variety the ciliary muscle is deficient in energy. Patients suffering from this form of asthenopia, may see well at long and short distances, but are unable to read a great length of time without the letters becoming confused and running into each other. The ciliary muscles get tired and through fatigue refuse to adjust the lenses until they have a few minutes rest.

Accommodative asthenopia is frequently associated with hypermetropia, therefore convex glasses may assist in remedying the defect. Something valuable may be gained by improving the conditions under which the eyes are used. The patient should have an abundance of light, and be placed so as to receive it to the best advantage. Reading should not be allowed in bed, or when the bodily powers are exhausted. Objects viewed should not be too high nor too low, but everything favorable to easy vision should be sought.

In some instances the patient loses confidence in his ability to use the eyes, and needs to be encouraged to employ them for a few minutes at a time, daily increasing the period of use.

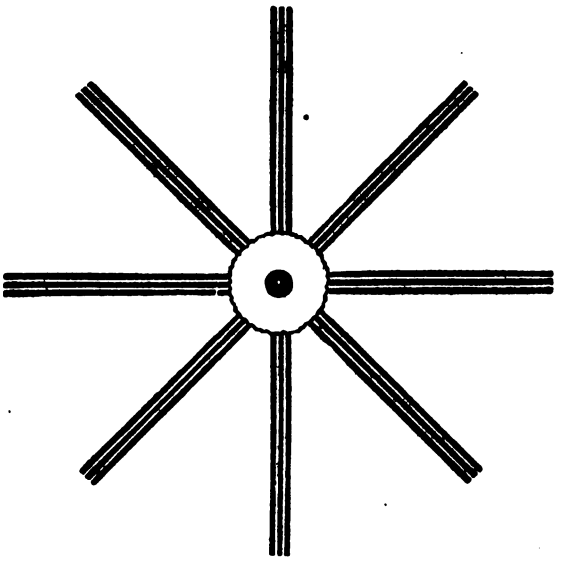
ASTIGMATISM.

The cornea does not always have the same curves from its centre to its border—there is asymmetry in its meridians. This irregularity of corneal surface does not refract the rays of light coming from different directions to a focus, consequently a very imperfect image is formed on the retina. The difficulty is called astigmatism, and is pretty common. The lack of symmetry in the different meridians of the cornea may be that of myopia at one point and hypermetropia at

another. An astigmatic person viewing a Greek cross sees distinctly the upright part and imperfectly the horizontal portion, or *vice versa.*

Astigmatism may be an hereditary affection, and then both eyes are symmetrically defective; or it may arise from disease which warps the normal curvatures of the cornea, and be confined to one eye. In advanced life one or both eyes may become astigmatic without the patient being aware of

FIG. 00.



The radiating lines form a series of crosses with equal arms, to test eyes suspected of astigmatism.

any visual defect. The *Boston Advertiser*, in a recent issue, contains the abstract of a lecture delivered by Dr. B. Joy Jeffries on "Defects of Vision Affecting Artists," which embraces some points illustrative of the defect under consideration.

"Astigmatism is the name given to a physical defect of the eye in which the cornea is at fault. Its curve is not the same in all its meridians, so that there is no perfect focus on the retina. The result is that a cross of equal arms may look quite uneven, the horizontal arms appearing longer or shorter than the vertical. Letters, especially certain type, may be

much blurred, greatly reducing the apparent power of vision. Ordinary spectacle glasses do not, of course, relieve this, and many persons may go through life without finding out that the deformity, for so it is, may be counteracted by appropriate *cylindrical* glasses, the selection of which requires the care and the attention of the specialist."

About a year ago, Dr. Liebreich, ophthalmic surgeon of St. Thomas' Hospital, London, delivered a lecture at the Royal Institution, in which he spoke of having examined several painters who suffered from this form of trouble, and explained how it affected their pictures. The special trouble it produced in a portrait painter was that he drew his faces too long. This was shown by the magic lantern being made astigmatic, and then properly corrected by the appropriate cylindrical glass to correct the astigmatism.

According to Donders there is ordinarily a marked difference between the refractive power exerted by the horizontal and the vertical meridians of the eye. The fact is demonstrated by placing a series of vertical and horizontal lines or bars at a distance of fifteen or twenty feet from the observer, and asking him to look at them steadily. The perpendicular stripes can be distinctly seen, while the horizontal ones will appear indistinct even at a diminished distance. And the converse of this holds good if the lines be brought near to the face. The perpendicular bars then become confused, and the horizontal well defined. This lack of correspondence in the refractive power of the vertical and the horizontal meridians of the healthy eye produces no appreciable inconvenience; but if the defect be exaggerated a little, considerable impairment of sight is the result.

Persons who have occasion to view large objects only, do not complain even if a high grade of astigmatism exists; but as soon as they engage in reading, writing, and the execution of fine work, slight degrees are very annoying and demand correction with proper glasses. When the focal distance varies in the two eyes, patients learn to evade the difficulty by placing their glasses obliquely across the nose. Astigmatics who do not wear glasses, learn to remedy the defect by holding the head so as to modify the refractive power.

There is often chromatic aberration in high grades of astigmatism. The image of dispersion appears surrounded

by circles of various hues; and the colors can be modified by the use of positive and negative glasses.

The ophthalmoscope may be employed to detect astigmatism, yet much experience with the use of the instrument is needed to apply the various tests in the investigation. Elongation of the optic disc, and an indistinct exhibition of the retinal vessels running in one direction, are among the phases which indicate astigmatism.

The presence and degree of astigmatism may be determined by the use of blackened metal plates which have slits cut in them. If a patient will press one of these plates close to the eye, and steadily rotate it, he will discover the direction the slit takes when vision is the sharpest, and another direction perpendicular to this, in which the indistinctness reaches a maximum. These two directions of the slit give the position of the two meridians where refraction is greatest and least.

When astigmatism depends upon ulcers and cicatrices of the cornea, or upon a defective lens, the anomalies of refraction constitute what Donders termed *irregular astigmatism.* This variety of astigmatic defect is not remedied by the use of spherical glasses, nor with other means.

As has been already indicated, *regular* astigmatism is to be corrected by the use of *cylindrical* glasses—or such as have one or both surfaces ground with a concave or convex cylindrical curvature. It requires great care and much experience in the adjustment of spectacles, to supply an astigmatic patient with proper glasses, and to give the best instructions for their use. The glasses when properly selected, or fitted for the peculiarities of the case, should be worn close to the eyes, and parallel to the plane of the pupil. Even after the errors of refraction are corrected, the vision of the patient may be seriously imperfect.

NYSTAGMUS.

Instability of the ocular muscles is not uncommon. The difficulty—called nystagmus—is associated or combined with strabismus. One eye is usually more unsteady than the other, and the patient is unable to fix the visual line on one point. An attempt to fix the eyes on any object results in aggravated

oscillation. The motor muscles do not steadily antagonize each other, but act in rapid alternation, and quite rhythmically in pairs or groups. The sight in one or both eyes is apt to be defective in patients thus disturbed in their ocular muscles.

The cause of nystagmus is unquestionably in the nerves imparting motion to the eyeball, or in that part of the brain from which these nerves have their origin. It has been declared that the primary defect is in the nerves of vision, and that the oscillations were a sequence—the eyes rapidly moving to catch a better view of objects. The fact that persons having congenital cataract are affected with rolling eyes, seems to favor the idea that the movements in nystagmus come from imperfect vision.

Twitching of the orbicularis muscle, or parts of it, is occasionally associated with unstable ocular muscles. However, the lid complication is not a necessity.

A peculiarity of nystagmus is that the eyes become quiet when turned laterally, in a horizontal or oblique direction, and are made to look upon a point at considerable distance. When the recti muscles are most affected the motion of the eyes is oscillatory; if the obliqui chiefly partake of the agitation, the movement is rotatory; and should both sets of muscles be involved, a *mixed* nystagmus exists. The agitation is increased by excitement, by straining the eyes to view near and minute objects, and by taxing the eyes when the illumination is scanty. When the eyes are brought into a condition of comparative steadiness, and then turned upon an object at a greater or less distance, especially to a point at one side or the other of the one steadily gazed upon, the agitation is provoked. The lateral motion necessary to follow the lines in reading, will throw the eyes into a state of tremulousness; and patients learn to turn the head, and not the eyes, or carry the book from side to side to avoid nystagmus, and to secure quiet vision. A book held at right angles to what it usually is, will enable some patients to read with greater facility, particularly if the recti muscles be at fault.

A paroxysm of nystagmus may be provoked by gazing at objects in motion, as the panorama of a crowded street; and considerable time is required in a quiet room to allay the fit of agitation.

Opacities of the corneæ, partial cataract, and congenital defects in the dioptric media, are causes of nystagmus; and when any one of these produces the tremulous movements, there is little hope of a cure unless the cause can be removed. Perhaps the corneal opacity will diminish, or the lens will improve, giving the oscillating eye an opportunity to become steady.

When strabismus is a complication, the division of one or more muscles may prove remedial. A partial severance of the internal recti has been attended with beneficial effects. A division of all the ocular muscles would render the eye steady, yet the operation is followed by a lack of mobility which is disagreeable. If the eyes tend to convergent squint, the internal recti may be divided first; and afterwards the external recti; and, finally, the obliqui.

Something may be accomplished by covering one eye with a compress, and using the other solely for a few weeks at a time. Then, to escape the dangers arising from inactivity, the bandage may be changed to the eye which has been in use, and the other will then enjoy the wonted stimulus of light. The wearing of a spectacle frame which has delicate springs to press gently upon the eyeballs, will enable some patients to overcome the oscillation.

Persons having nystagmus should select an occupation which does not require steady vision. There are many trades which are carried on by the use of the hands or the sense of touch, vision not being necessary to the manual execution.

Electricity has been employed with the hope of curing nystagmus, but very little benefit has arisen from this or other agencies. The tremulous condition having existed from youth, a habit is established which, like stammering and other habits, is exceedingly difficult to overcome.

SNELLEN'S TEST TYPES.

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When the United States ceased to be a part of the British empire, and assumed the character of an independent nation, they became subject to that system of rules which reason, morality and custom had established among the civilized nations of Europe, as their public law. During the war of the American Revolution, Congress claimed cognizance of all matters arising upon the law of nations, and they professed obedience to that law, "according to the general usages of Europe." By this law we are to understand that code of public instruction, which defines the rights and prescribes the duties of nations in their intercourse with each other. The faithful observance of this law is essential to national character, and to the happiness of mankind. According to the observation of Montesquieu, it is founded on the

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principle, that different nations ought to do each other as much good in peace, and as little harm in war, as possible, without injury to their true interests. But as the precepts of this code are not defined in every case with perfect precision, and as nations have no common civil tribunal to resort to for the interpretation and execution of this law, it is often very difficult to ascertain to the satisfaction of the parties concerned, its precise injunctions and extent; and a still greater difficulty is the want of adequate pacific means to secure obedience to its dictates.

3

There has been a difference of opinion among writers concerning the foundation of the law of nations. It has been considered by some as a mere system of positive institutions, founded upon consent and usage; while others have insisted that it was essentially the same as the law of nature, applied to the conduct of nations, in the character of moral persons, susceptible of obligations and laws. We are not to adopt either of these theories as exclusively

3½

true. The most useful and practical part of the law of nations is, no doubt, instituted or positive law, founded on usage, consent or agreement. But it would be improper to separate this law entirely from natural jurisprudence, and not to consider it as deriving much of its force and dignity from the same principles of right reason, the same views of the nature and constitution of man, and

4½

the same sanction of Divine revelation, as those from which the science of morality is deduced. There is a natural and a positive law of nations. By the former, every state, in its relations with other states, is bound to conduct itself with justice, good faith and benevolence; and this application of the law of nature has

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been called by Vattel the necessary law of nations, because nations are bound by the law of nature to observe it, and it is termed by others the internal law

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of nations, as it is binding upon them as a matter of conscience.

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The rights, duties, and responsibilities which arise from natural law

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No man
can dis-
obey the
laws of
nature.

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